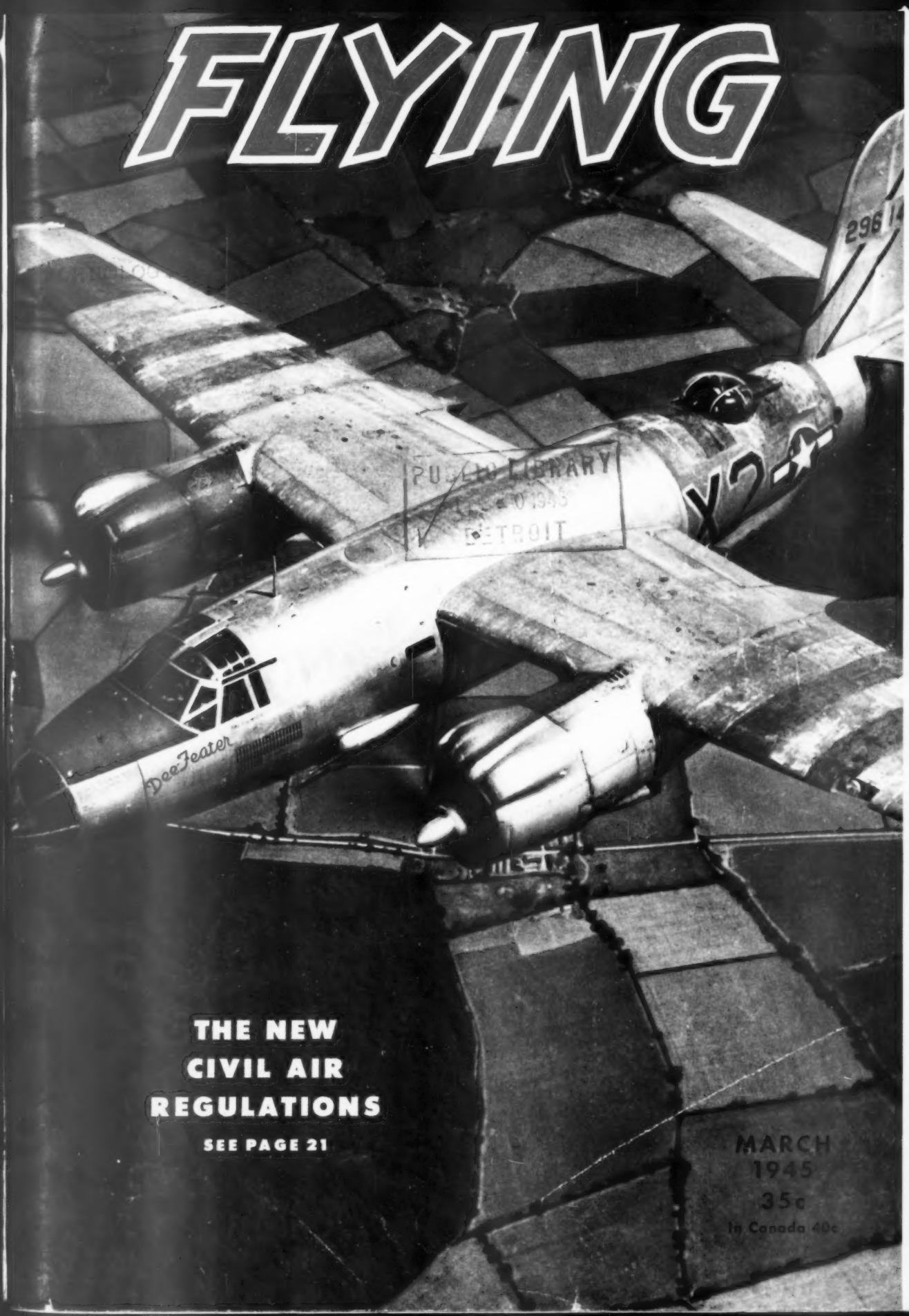
FLYING



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DETROIT

THE NEW CIVIL AIR REGULATIONS

SEE PAGE 21

MARCH
1945
35c
In Canada 40c

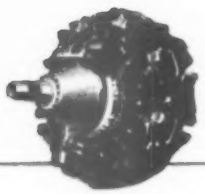
Greater Pay-Loads with Fill-in Freight

Greater still with Cyclones

Hotel rooms vacant overnight, empty seats in the orchestra, or a plane in flight with unfilled passenger or cargo space, all these represent revenue lost forever. The same holds true of any space sold by the hour or mile; anything less than capacity is a sales opportunity permanently lost.

In the air transport field, fill-in freight to build up full payloads is one way of getting capacity use on every flight. A constant stockpile of such freight, moving at preferential rates, fills the balance of weight and space capacity after loading passengers, mail and air express. Such rates gradually attract more and more commodities to air travel. The net results: full payloads and increased revenue on every flight.

To such flight operations, Wright Cyclones contribute an extra bonus in payload, due to their lower weight ratio and low fuel consumption. In addition, their ease of maintenance adds to the reasons why these dependable sources of power pay their way.



Cyclones Save 3 Ways

LESS WEIGHT—MORE PAYLOAD
LOWER FUEL CONSUMPTION
REDUCED MAINTENANCE

WRIGHT

Aircraft Engines

WRIGHT AERONAUTICAL CORPORATION
A Division of
Curtiss-Wright Corporation
Paterson, New Jersey, U.S.A.

WRIGHT POWERS THE TONNAGE OF THE AIR

Flights cancelled...all over town

Weather that downs wild ducks doesn't stop planes . . . because B. F. Goodrich put rubber on wings

ONE NIGHT it "rained ducks" in Thief River Falls, Minnesota!

It happened during the year's first sleet storm. All night long, the seasonal flight could be heard passing over. Then, about 4 A.M., ducks began dropping in—literally. Thousands of them crashed into the streets, wires, and buildings. Ice had coated their feathers and forced them down.

Up until 1930, airplanes had even less protection than these ducks in icing weather. Then B. F. Goodrich introduced what turned out to be one of the greatest single contributions to flying safety. It was the first device that successfully knocked ice off airplane wings. They made it out of rubber and fabric and called it a De-Icer.

B. F. Goodrich De-Icers are long rubber strips attached to the front edges of wings and tails (most ice forms here). Tubes inside a De-Icer inflate and deflate by air pressure in regular pulsation. This causes a flexing action like bending a rubber ice tray and has a similar result. The ice cracks off and is carried away in the windstream.

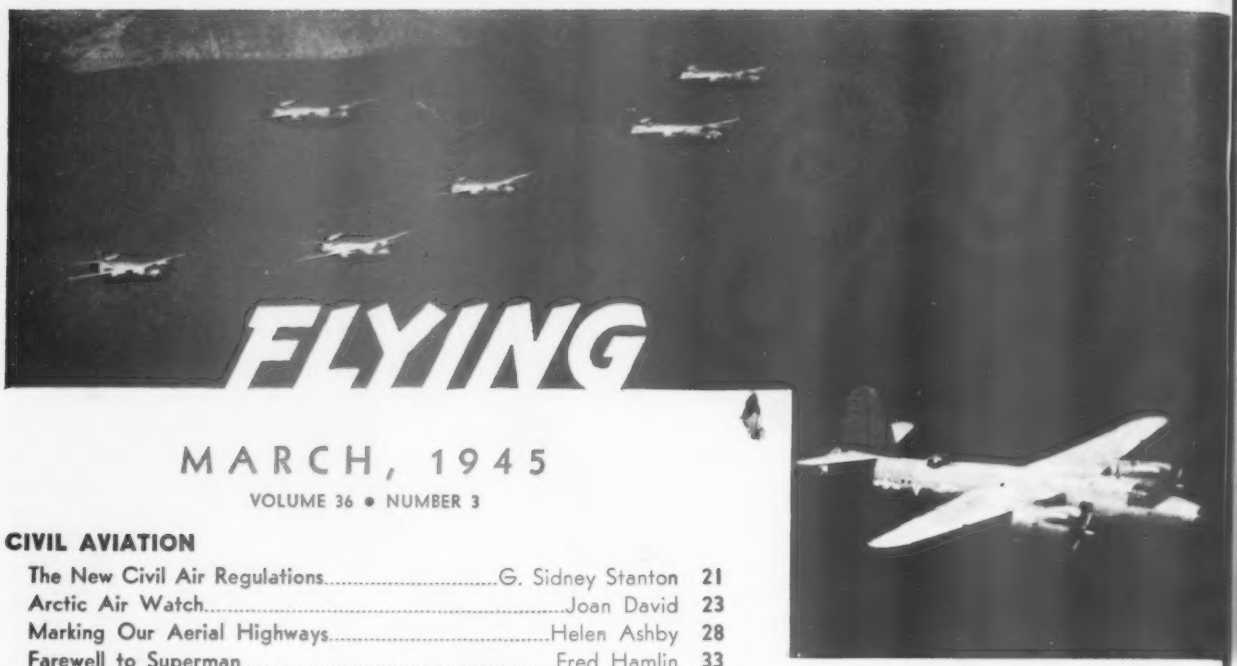
Today, the airliner you fly in has B. F. Goodrich De-Icers as standard equipment. Bombers, cargo planes, transports, and fighters fly with De-Icers through some of the worst icing conditions known.

The De-Icer is one of a whole family of products protecting fliers all over the world. Among these are tires, from training types to super-bomber bearers; self-sealing gasoline tanks and hose; life rafts. Altogether, more than 80 aircraft products carry the name B. F. Goodrich...a name to watch for wherever rubber flies. The B. F. Goodrich Co., Aeronautical Division, Akron, Ohio.

Skyway or Highway

B.F.Goodrich

FIRST IN RUBBER



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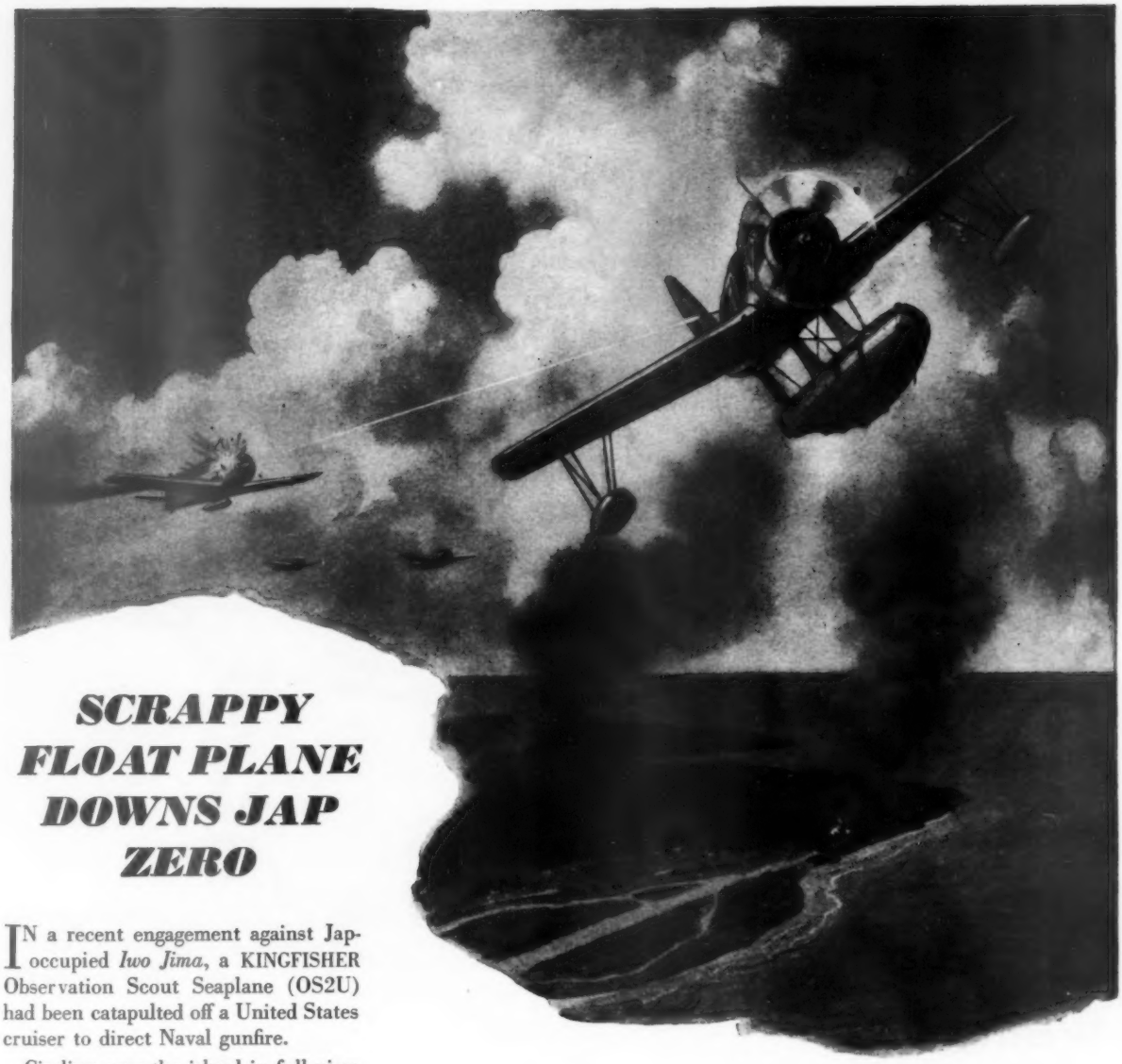


SCRAPPY FLOAT PLANE DOWNS JAP ZERO

IN a recent engagement against Jap-occupied *Iwo Jima*, a KINGFISHER Observation Scout Seaplane (OS2U) had been catapulted off a United States cruiser to direct Naval gunfire.

Circling over the island in full view of an enemy airfield, Lieutenant Robert W. Hendershott, U.S.N.R., of Bend, Oregon, pilot of the lightly armed little float plane, calmly proceeded to fulfill his hazardous but vitally important mission.

The slow-cruising Kingfisher looked like an easy mark to the Nip's nest of Zero fighters. Hardly had the surface vessels begun their bombardment, when Hendershott's Observer, Arthur E. Hickman, Aviation Radioman, second class, U.S.N.R., of Denver, Colorado, spotted three Zeros spiralling up.

Rapidly gaining altitude, the enemy planes opened fire on the Kingfisher from below. The lead attacker made a stern approach. Hickman, crouching over his light machine gun, coolly bided his time, and as the fast, heavily armed Zero came within range, let go with a perfectly aimed burst into its engine.

Hickman's bullets must have killed the Jap pilot. For the Zero roared on in—sheared off the Kingfisher's starboard wing tip—and crashed into the sea.

The second Zero came on. Its bullets ripped through the Kingfisher's fuselage within inches of the Navy pilot's legs. The oil tank was punctured. Hot oil spurted over the windshield and cockpit.

Again and again, the two fast and highly maneuverable Jap fighters slammed at the crippled Kingfisher. The fuselage was completely riddled. Finally, Pilot Hendershott maneuvered his plane within reach of the protecting screen of U. S. destroyers and cruisers—and the Jap fliers pulled away!

Score: One Edo float equipped Navy Seaplane damaged. One latest-type Zero knocked into the sea. Two other Zeros badly baffled by a non-combatant observation plane manned by two very combat-minded Navy men. The Japs should file a complaint!

EDO FLOAT GEAR
SERVES THE UNITED NATIONS

EDO AIRCRAFT CORPORATION
41st SECOND ST., COLLEGE POINT, L. I., N. Y.

Finish the Fight — with War Bonds

Skyscraper

Stand where you can look at one single part of the Boeing B-29 Superfortress . . . the huge tail, tall as a three-story house. High above you are the deadly hooded guns and the tail gunner's compartment of bullet-proof glass. Horizontal tail surfaces reach out on either side, wider than the wingspread of what was once considered a good-sized airplane.

Size alone is not the remarkable thing about the B-29, however; there have been big airplanes before.

But there has never been a plane that would carry as heavy a bomb load so far, so fast, so high.

Nor has such an airplane ever before been successfully designed, tested, and manufactured in quantity . . . in time to get into action *during* a period of war!

Boeing measured up to this stupendous task which included engineering the B-29 so that it combined high-performance characteristics with great load-carrying ability; and manufacturing it on a scale never before thought possible for so large and potent an aerial weapon.

This latter meant the blazing of new trails in tooling and production planning. It meant the originating of completely new facilities and processes. It meant not only the making of the manufacturing plan and putting it into operation in Boeing's own plants, but assisting the other aircraft manufacturers, which were chosen by the Army to help Boeing build the B-29's. And it meant doing all these things while the Superfortress itself was still in the development stage!

Today the Boeing Superfortresses are taking their place alongside the famous Flying Fortresses as a great fighting team. They represent Boeing's effort to provide American Air Force crews with the best possible weapons for performing their vital and hazardous missions.

Tomorrow Boeing research, design, engineering and manufacture will be applied to peacetime airplanes for your use . . . your assurance that any product "Built by Boeing" is bound to be good.

DESIGNERS OF THE B-29 SUPERFORTRESS • THE FLYING FORTRESS • THE NEW STRATOCRUISER
THE KAYDET TRAINER • THE STRATOLINER • PAN AMERICAN CLIPPERS

BOEING

RYAN PRODUCTION ENGINEERING DEVELOPMENT NO. 28-30.18

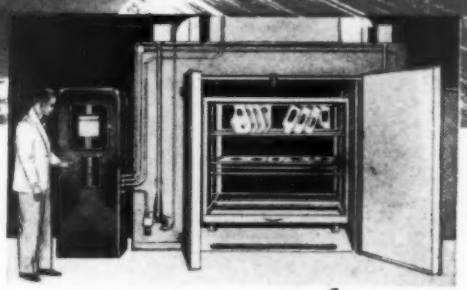
Faster, Lighter Aircraft, Greater Pay Loads through New Techniques in Processing Aluminum Alloys...

How to develop airplanes capable of carrying greater pay loads at higher speeds by reducing structural weight? That's the aeronautical engineer's basic problem.

To accomplish this end could a metal be found which had the lightness of Aluminum and the strength of steel? Yes, Aluminum alloys could be post-aged to give them this much desired strength. But, the process so reduced the corrosion resistance of the metal that full advantage could not be taken of this development.

Ryan metallurgists tackled the problem and came up with a procedure which yields a light corrosion-resistant alloy with the strength of low carbon steel.

Ryan engineers have been *first* to make full use of this weight-saving development in the design and construction of aircraft. This advantage, which adds to the deadliness of American warplanes, will be equally valuable to the peacetime planes of the future.



THE PROBLEM: How to take advantage of the extra strength imparted to Alclad 24-S by the post-aging process. The strength of this metal, composed of an Aluminum alloy covered with a thin deposit of pure Aluminum, may be increased by post-aging. However, this has always been accompanied by a loss in corrosion resistance which prevented aeronautical engineers from completely utilizing this advantage. The aging reduced the galvanic potential between the alloy and the clad Aluminum and removed the electrolytic protection it afforded.

THE SOLUTION: Ryan research found a way to obtain the strength increase and maintain high corrosion resistance: The Alclad is placed in an oven and held to a temperature of 365° F. for ten hours. This induces a copper precipitation and raises the tensile strength at least 20%. Then the corrosion resistance is restored by anodizing a thin layer of oxide on the surface and spraying it with a zinc chromate primer.

THE ADVANTAGES: By ordering specified stock, post-aging at carefully controlled temperatures and anodizing and priming, Ryan has created new possibilities for Aluminum alloys. The entire aircraft industry may now have the benefit which this metal, with Aluminum's lightness and steel's strength, gives to every designer and builder of airplanes.

RELY ON RYAN TO BUILD WELL

1922 1945

RYAN *Airplanes*

Ryan Aeronautical Company, San Diego — Member, Aircraft War Production Council, Inc.

DESIGNERS AND BUILDERS OF NAVY FIGHTING PLANES AND EXHAUST MANIFOLD SYSTEMS

. . . they'll all be easy "week ends"

Tired of snow, slush, chilling winds? Well, even if you can spare only a week end, you're within easy reach of White Sulphur, Gulfport, or Palm Springs . . . maybe all three . . . *when you Cessna.*

Whatever warm, sunny "fountain of youth" calls you when wintery winds blow, there's your very best answer . . . a precision-built, safety-engineered, postwar Cessna of your own.

when you CHOOSE CESSNA!

THE BOEING B-29 SUPERFORTRESS

Nineteen reasons why... for your postwar personal airplane, you too will *choose Cessna.* They are the nineteen important units—wing leading edges, rudders, elevators, fins, dorsal fins and other vital parts—that Cessna is making for the Boeing Superfortress.

This work has given Cessna the two things indispensable in building the airplane of all-metal structure that you will want for your postwar Family Car of the Air—modern, precision, production facilities plus priceless manufacturing and engineering experience.

After the war, we'll need time for reconverting our plant . . . and then you'll be able to select your Family Car of the Air . . . to meet all your travel needs and your pocketbook . . . from the complete line of new Cessnas, *all Cessna-Engineered for Safety,* economy and performance.

Cessna

THREE TIMES JUDGED "THE WORLD'S MOST EFFICIENT AIRPLANE"

Safety Signal for Smart Pilots

The ability to control a plane with *precision* during landing, take-off and similar maneuvers is one of the biggest thrills in flying. And the sooner you learn to depend on instruments —reliable instruments—the quicker you'll master that control. More than two-thirds of all light-plane accidents are due to faulty human flying judgment. In many cases, *a glance at the instrument panel* would have corrected that judgment, saved a plane, saved a life.

Write today for "Facts About Kollsman Instruments" and what they contribute to the safety, enjoyment and utility of flight. Kollsman Instrument Division, Square D Company, 80-02 45th Avenue, Elmhurst, New York.

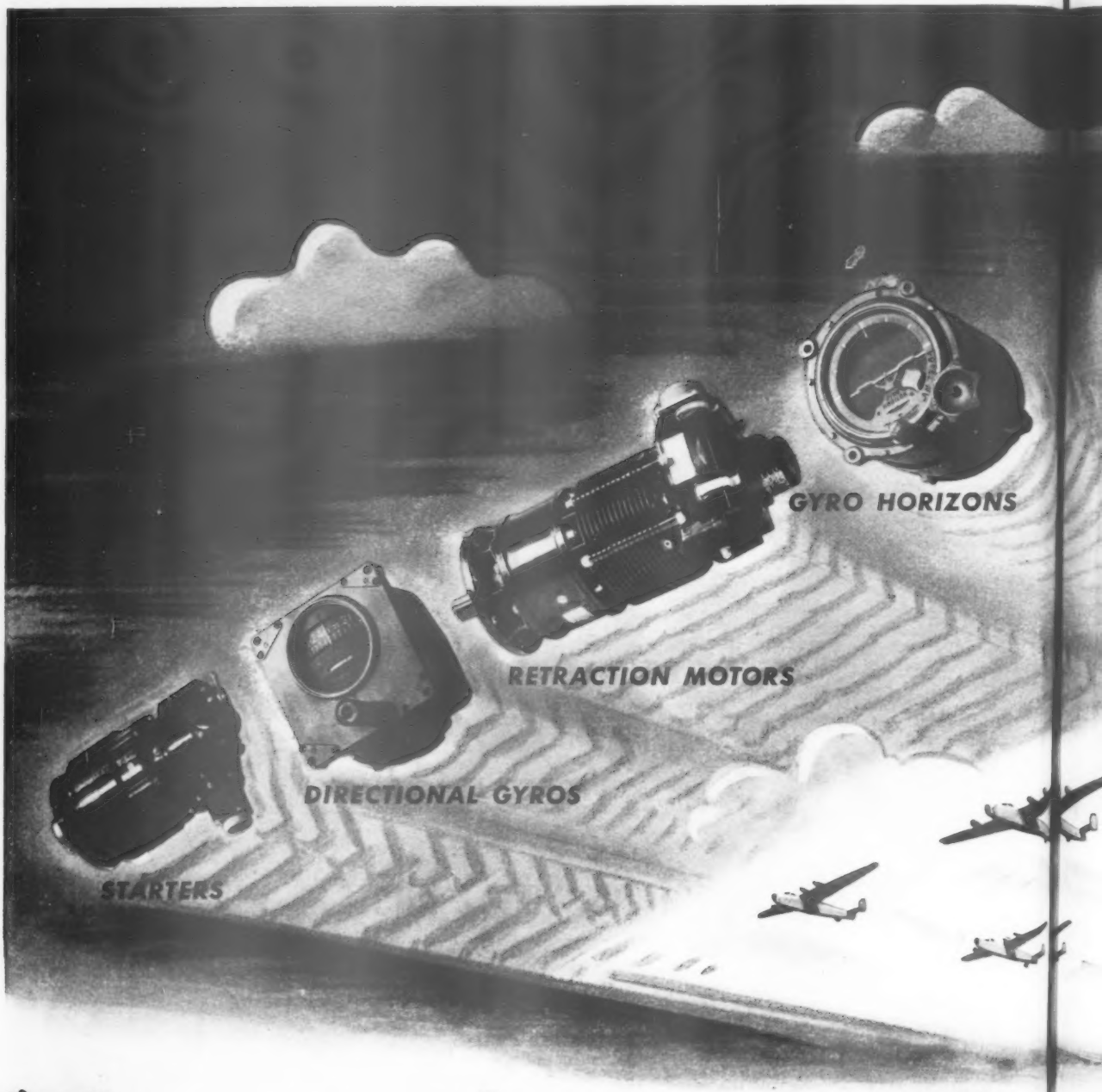
This is the Kollsman Airspeed Indicator, vital in maintaining safe flying speed and important to accurate cross country navigation. In landing, for instance, it tells you whether you are maintaining enough speed to avoid a stall.

KOLLSMAN AIRCRAFT INSTRUMENTS

PRODUCT OF

SQUARE D COMPANY

ELMHURST, NEW YORK · GLENDALE, CALIFORNIA

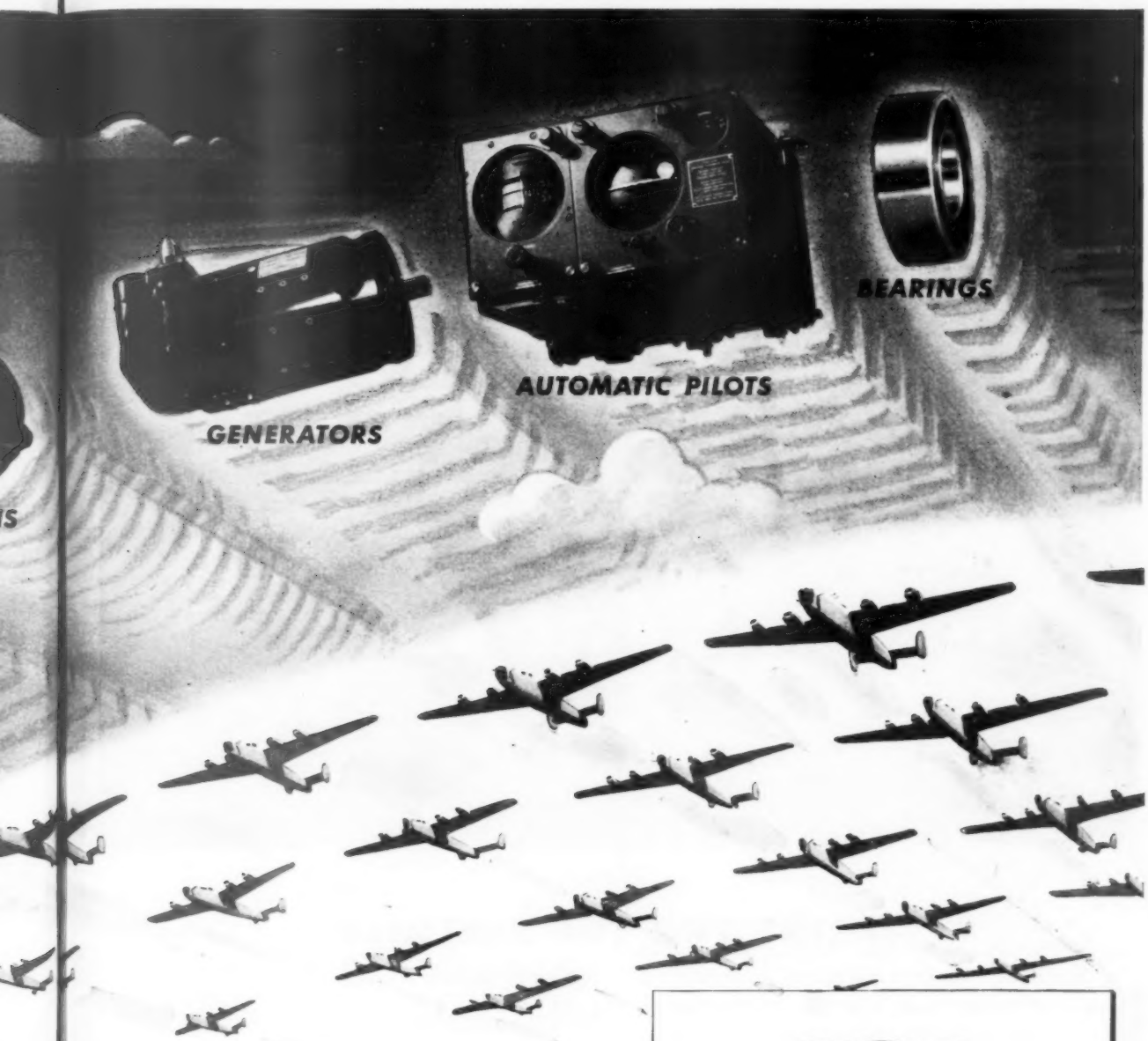


"These are a few we can talk

Today, the eight Jack & Heintz plants are turning out 36 different war products—in unending streams for the finest aircraft in the world. Our newest assignments are military secrets, but jobs we *can* talk about now are the instruments, auto pilots, generators, starters, motors and bearings that have gone to war by the tens of thousands.

This equipment is used in pursuit planes, bombers, transports, patrol boats, trainers, gliders . . . and even blimps. Its performance has been such that the Jack & Heintz nameplate is now a welcome sign of dependability to the men who gamble their lives on it daily in every corner of the globe.

From the first, Jack & Heintz has led the



about now"

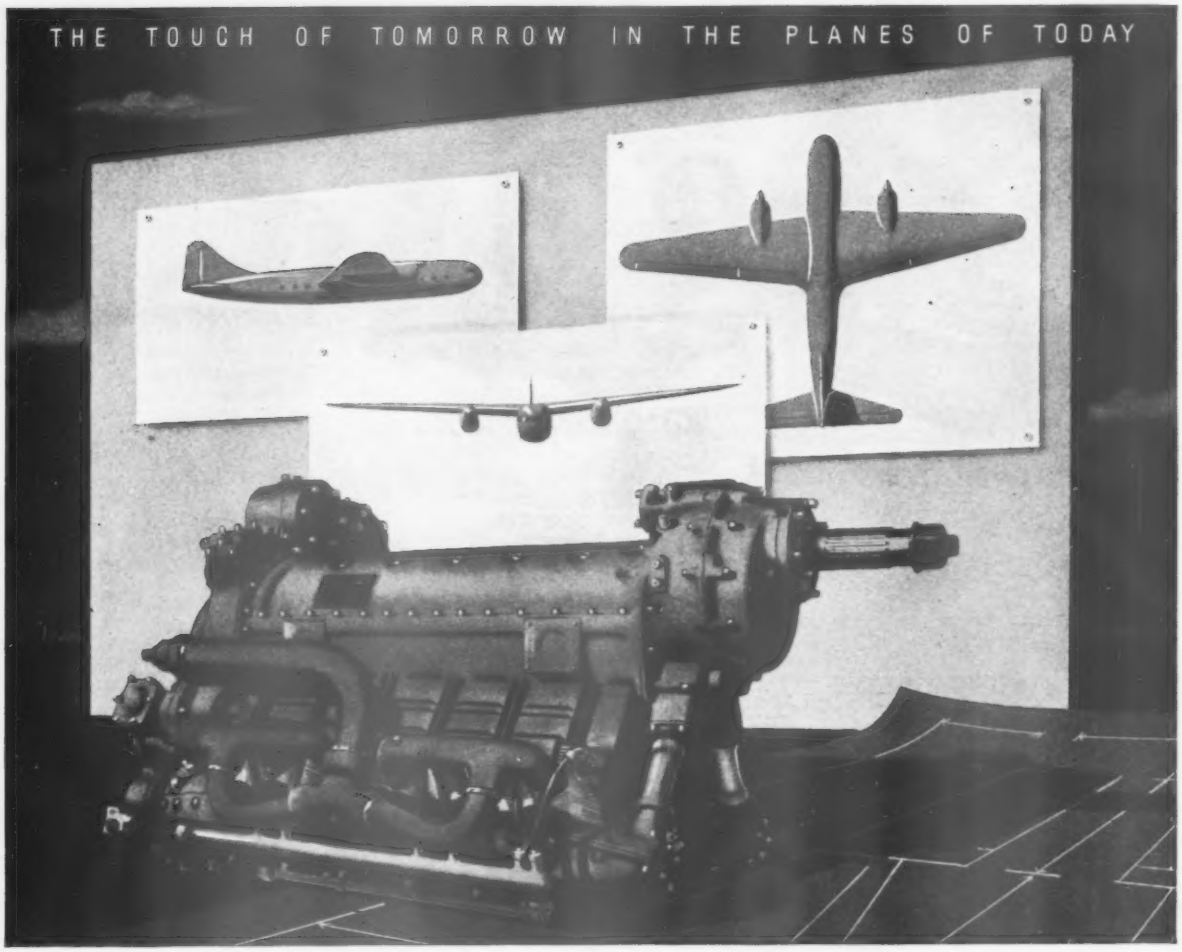
way in reducing weight, boosting output and increasing service life on every job undertaken. Engineering like this has helped keep America's air fleet first in the war . . . it will be equally effective in holding that place in peace.

Watch Jack & Heintz for new things in aircraft!

JACK & HEINTZ
Incorporated

Buy More War Bonds and Stamps

Jack & Heintz, Inc., Cleveland, Ohio, manufacturers of Aircraft Engine Starters, Generators, Gyro Pilots, Gyro Flight Instruments, Magnetos, Motors.



INLINE FOR THE AIRLINES

Here in this clean, compact package is power for the airplanes of tomorrow—airplanes that will knit together the world's growing network of airways.

Latest in production of a long line of Ranger engines, the Ranger Twelve is ready to take its place as the efficient power plant for feeder line transports of the new air age.

Constantly improved since its inception, Ranger Twelve is backed by fifteen years of Fairchild experience in building aircraft engines. Its dependability is assured by Fairchild precision construction and a heritage of careful research and engineering skill.

Inline, aircooled, inverted; one of the few truly highspeed aircraft engines in existence, the Ranger Twelve delivers *smooth* power. The simplicity of its design can sharply reduce the airline operators' inspection and maintenance expense.

Within its design, too, lies a promise . . . a promise for even greater efficiency and sleekness in new Rangers to come through that quality built into all Fairchild products, "the touch of tomorrow in the planes of today."

BUY U. S. WAR BONDS AND STAMPS

RANGER AIRCRAFT ENGINES

Division of Fairchild Engine and Airplane Corporation • Farmingdale, Long Island

For more Speed in the "Tight Spots"

Photo courtesy Republic Aviation Corporation

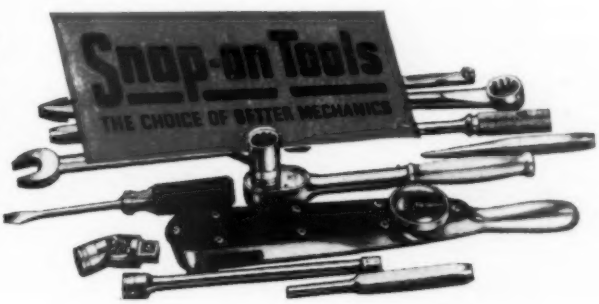
—Use Flexible, Versatile Snap-on "Combinations"

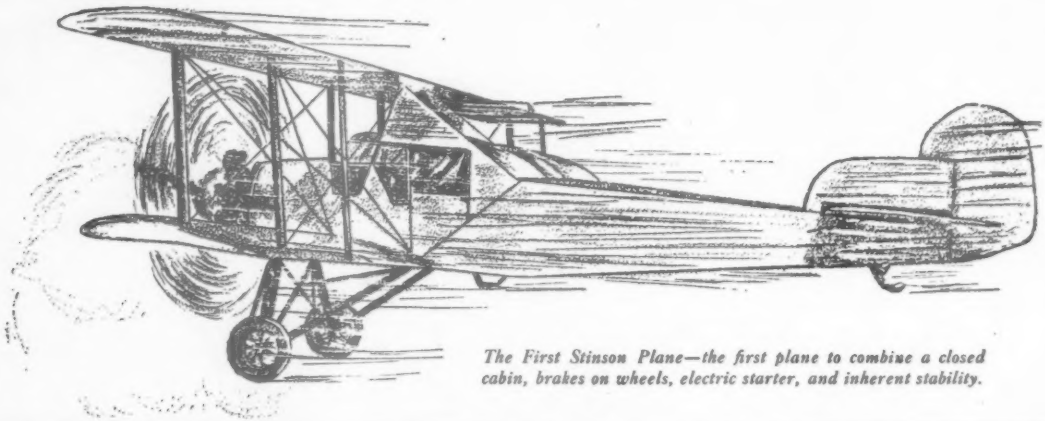
Remember back when "tight spots" were roundly damned as "bad design". Today they are the accepted penalty of *good design* . . . the unavoidable result of packing incredibly high performance into sharply restricted dimensions.

And for the toughest tight spots there are modern Snap-on tools . . . versatile "combinations" that reach into deepest pockets, grip hidden nuts securely, turn them easily, swiftly, solidly. The instant adaptability of Snap-on sockets, handles and ratchets, multiply the range of a compact Snap-on kit into hundreds of speed tools for specialized applications. *And frequently save the cost of specially designed one-job tools!*

Snap-on nation-wide service, with 38 factory branches in key production centers, provides right-at-hand personal tool service to industry everywhere. Write for Snap-on catalog and address of nearest branch.

SNAP-ON TOOLS CORPORATION
8024-C 28th AVENUE KENOSHA, WISCONSIN





The First Stinson Plane—the first plane to combine a closed cabin, brakes on wheels, electric starter, and inherent stability.

Stinson "firsts"— before, during, and after

THE NAME "STINSON" has been associated with personal plane aviation leadership ever since that name was first given to an airplane, back in 1926.

When this 1926 Stinson took to the air, it carried aloft an impressive number of "firsts."

DESIGN "FIRSTS"

Stinson was the first plane to combine the following features:

- An enclosed cabin
- The safety afforded by brakes on landing wheels
- The convenience of an electric starter
- The comfort of a cabin heater

PREWAR PERFORMANCE "FIRSTS"

During the past 19 years Stinson has piled up an impressive number of performance "firsts" in the fields of commercial and personal flying:

- A Stinson plane carried the first air mail in China
- It carried the first government mail in Mexico and in the Philippines
- Made the first flight from Detroit to Tokyo, and from New York to Bermuda
- Inaugurated the world's first air-mail pick-up service
- First explored the Greenland route to Europe, the present-day route of the North Atlantic Air Ferry.

Stinson "Flying Jeeps" serve the armed forces as flying ambulances, observation and liaison planes, under the toughest flying conditions.

STINSON "FIRSTS" DURING THE WAR

Stinson's main wartime job has been the manufacture of liaison and training planes for our fighting forces—the Stinson Sentinel, or "Flying Jeep," the Stinson Vigilant L-1, and the Stinson Reliant AT-19.

A Stinson Sentinel, hopping from the deck of a carrier, was the first American plane to land on Jap-infested Pelelieu Island, while U. S. Marines were slugging it out for the beachhead . . . only one typical instance of many similar occurrences when Stinson planes took part in invasions.

"Out in front" of the front, these sturdy little Stinson "Flying Jeeps" are serving as the "eyes" of the armed forces, as flying ambulances, and on important liaison duty.

The Stinson Voyager is the No. 1 plane of the Civil Air Patrol. It has the distinction of carrying out 65 per cent of the Patrol's wartime operations, which have included the sinking of a number of submarines and the saving of hundreds of lives.

The Stinson "Flying Jeep"—wartime successor to the peacetime Voyager—has demonstrated its stamina and utility as the No. 1 liaison plane of the Army, Navy, and Marine Corps all over the world.

The Stinson Reliant AT-19 has been widely used as a navigational trainer by the British. And almost every airline in the United States uses Stinson planes to train and check their pilots.

THE STINSON VOYAGER 125 . . .
the No. 1 Plane for Postwar Personal Flying

The first postwar personal plane designed by Stinson—the Voyager 125—combines the *safety* and *reliability* of the prewar Voyagers with the *toughness* and *utility* of the Stinson "Flying Jeep."

Here are some of the high lights of this quality personal plane—

- Carries three passengers in addition to pilot.
- Maximum speed of 123 m.p.h. at sea level.
- Range of 470 miles without refueling.
- Service ceiling 14,000 ft.
- 545-ft. take-off run; 265-ft. landing roll—with flaps down.
- Powered by 125 h.p. engine.
- Cruising speed of 112 m.p.h. at 83 per cent power.
- Rate of climb—750 ft. per minute at sea level.

Parts for Stinson Planes. We are now making a full line of parts for the thousands of Stinson planes now in service. Order spare parts for your Stinson from your local Stinson distributor or direct from the factory.

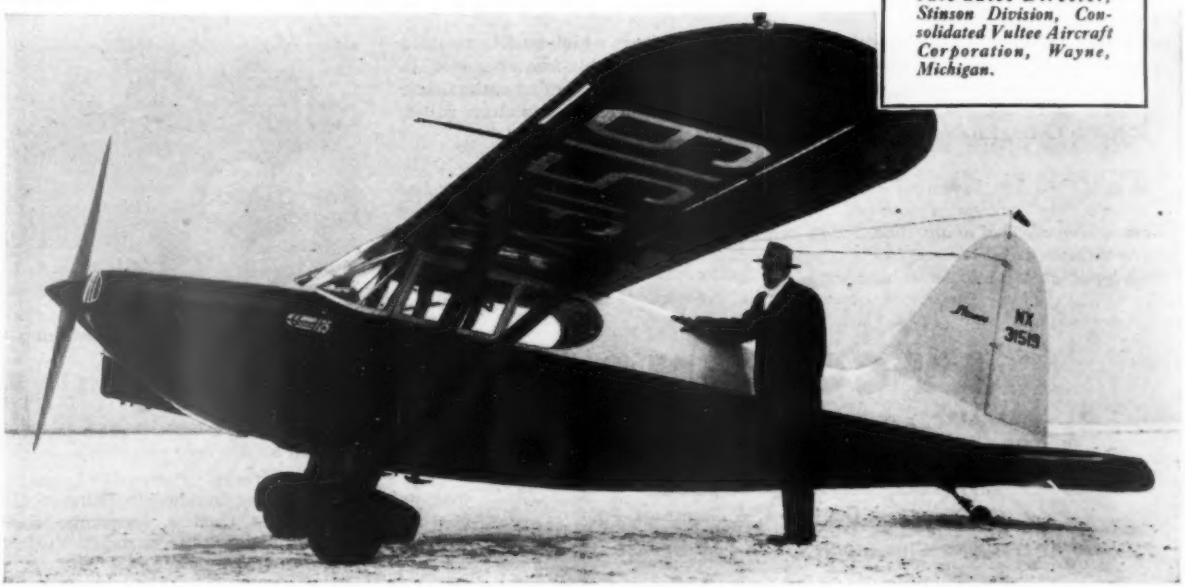
Stinson

The Aircraft Standard of the World

Division of Consolidated Vultee Aircraft Corporation, Wayne, Michigan

The Stinson Voyager 125 is the forerunner of a distinguished line of planes for personal flying that Stinson will make as soon as war conditions permit.

We welcome inquiries about the Voyager 125 and about Stinson's postwar plans. Write to Private Sales Director, Stinson Division, Consolidated Vultee Aircraft Corporation, Wayne, Michigan.



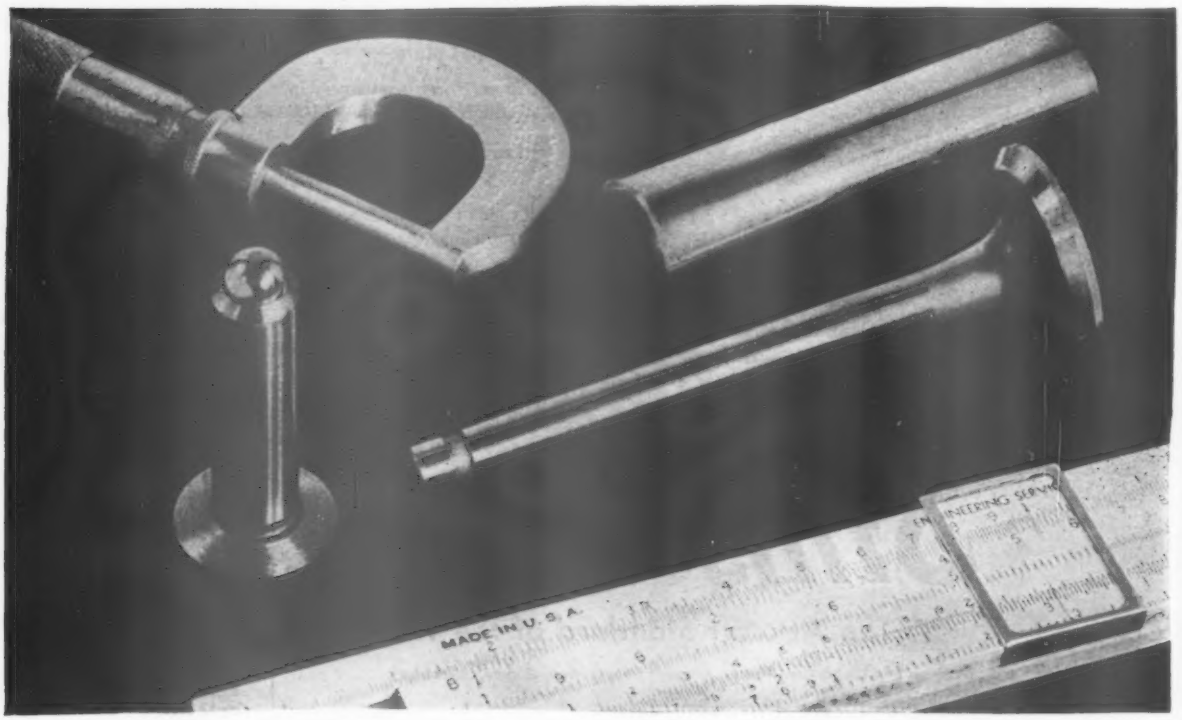
Does(+)or(−).0002" make a difference in a 65 h.p. engine?

At Lycoming we're sure it does. Men who fly Lycoming engines agree. Tolerances in our piston pins are held to *two ten-thousandths of an inch!*

And throughout . . . the same meticulous accuracy that goes into a $25,000 combat engine goes into *your* Lycoming 65.

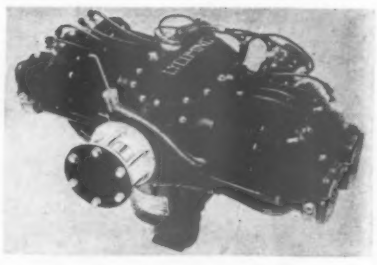
For instance . . .

- Every primary part in any Lycoming Engine is *Magnaflux inspected.*
- Every engine is *test-run for 7 hours; torn down, inspected, given a shakedown run, checked and then given a final test run.*
- Every Lycoming must pass approximately 2700 inspections before it earns its name.



This unending care in manufacture and inspection results in a high quality aviation engine—that proves its "breeding" day after day in trouble-free operation, in economical and dependable service. Here is just one of the scores of enthusiastic reports on Lycomings. Mr. E. E. Marshall, adjutant of CAP Squadron 619-4, of North Cairo, Illinois writes . . .

"MY 65 h.p. Lycoming has logged over 752 hours. This engine has never had either a "top" or a major overhaul. Neither has the crankcase nor any of the cylinder heads been removed at any time. Yet its performance is still excellent. Everyone here at North Cairo Airport is sold 100% on your product and want their next aircraft to come equipped with a LYCOMING ENGINE. *"*



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They're All Betting on Bellanca

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The recently-compiled results of the Bellanca Aircraft Quiz indicate that the Bellanca engineering staff claimed less than it had actually achieved. Quiz returns now show clearly that for post-war flying America wants a three to four-place low wing monoplane, with retractable landing gear and an aircooled engine of 120 to 150 hp. Cruising speed of 120 mph and top speed of 140 mph received the majority vote.

The actual specifications of the Bellanca Cruisair, equipped with Franklin 6-cylinder engine, closely approximate the expressed wishes of pilots, men and women in the Armed Forces, businessmen, physicians, chartered plane and fixed base operators, farmers, sportsmen, newcomers to flying, veteran pilots and many others.

So it is that they're "all betting on Bellanca"—with confidence that Bellanca post-war airplanes will possess those outstanding features which have characterized Bellanca Aircraft in the past—efficiency, economy of operation, sturdiness and high performance. They know that the organization which brought to America so many historic records has also the ability to produce the all-purpose airplane for which they have registered their preferences.... Bellanca Aircraft Corporation, New Castle, Delaware.

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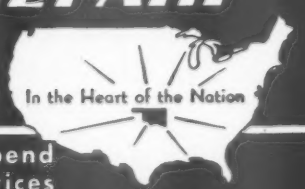
Division of SPARTAN AIRCRAFT CO.

Established 1928 TULSA, OKLA.



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Breeze Flexible Conduit

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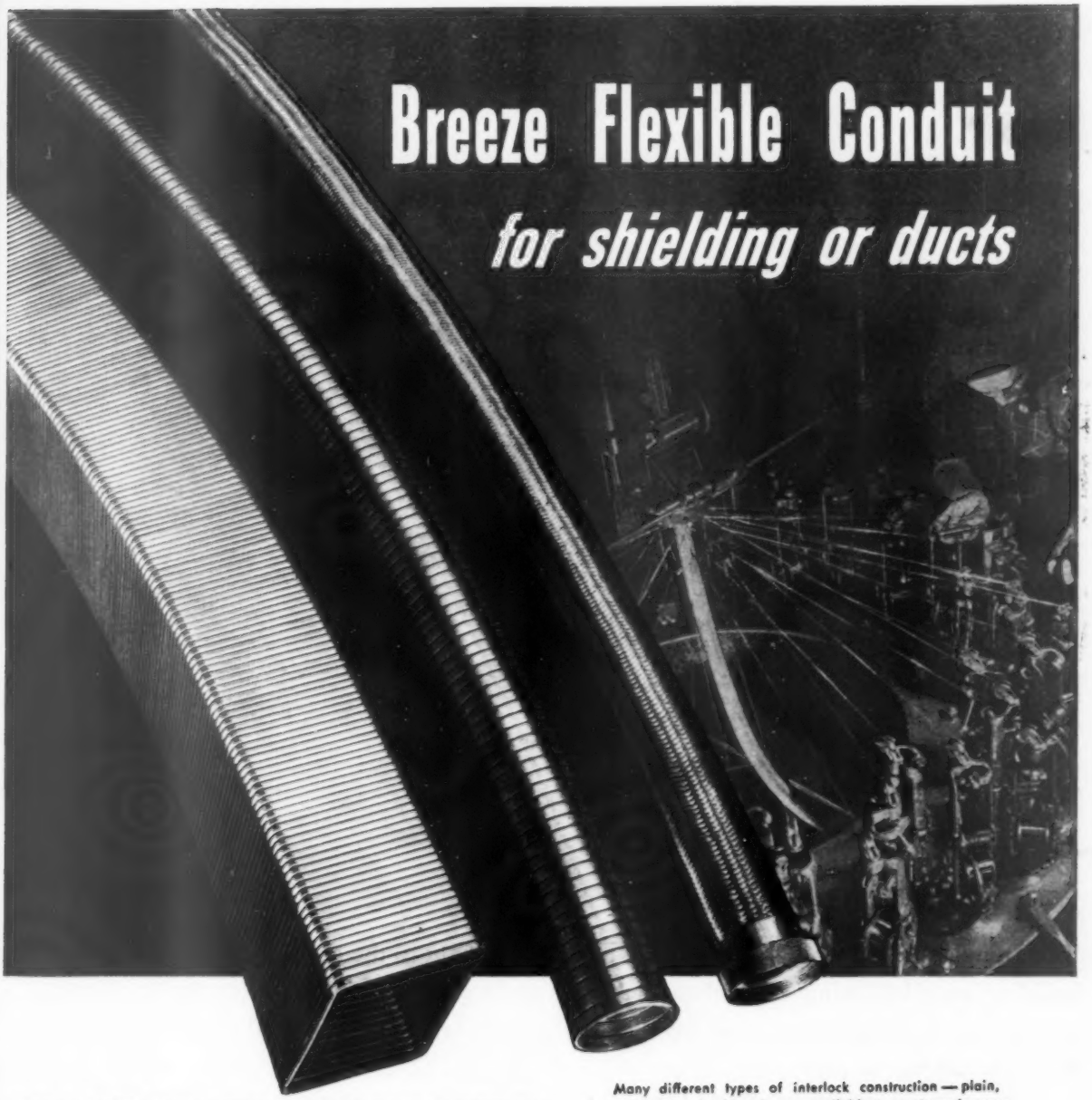
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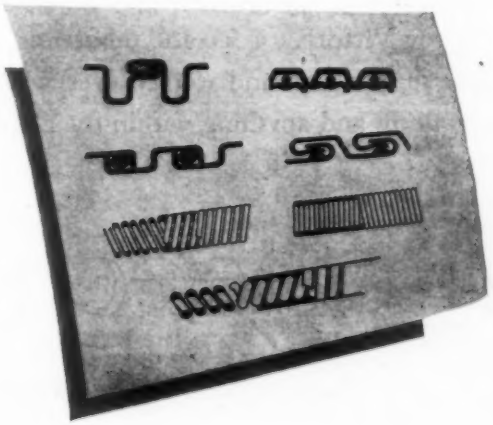

Breeze BREEZE MARK

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BEECHCRAFTS ARE DOING THEIR PART WICHITA, KANSAS, U. S. A.

The NEW CIVIL AIR REGULATIONS

By G. SIDNEY STANTON

☆

CAA offers drastic revision of rules governing aircraft operation, air traffic and pilot certification, in move to encourage private flying.

☆

THE year 1945 offers good news for all those interested in private flying. The Civil Air Regulations are up for a thorough revision.

Furthermore, the private pilot examination will no longer cause the student to quake with fear but will be regarded as a simple, routine and welcome contribution to the pilot's mastery of flight.

For some time it has been felt that the material which the private pilot was required to wade through in order to prepare for the written exam was altogether too bulky—containing more than 1,500 pages weighing about six pounds. Examinations were thought longer than necessary—the time limit was four hours; too difficult—the number of failures was proportionately high; and too theoretical—many of the questions bore little relationship to practical pilot requirements.

The Civil Aeronautics Administration has recognized the need for making a concise manual available to the pilot. Under the supervision of Fred Lanter, director of safety regulation, a booklet of about 100 pages is being prepared which will contain all the information necessary for the written examination. The examinations themselves are being revised under the direction of William B. Davis, chief of the airman and agencies section, and will be materially shortened, co-ordinated with the new instruction book, and definitely related to actual situations which the private pilot is likely to face. Work will be completed within the next few months so that by late spring the private pilot examination, instead of being an ogre to frighten the timid student pilot, will become a concise, meaningful test of minimum requirements

which will assure the pilot that he has mastered the important fundamentals enabling him to fly with confidence and with safety to himself and others.

Simplification of Civil Air Regulations has proved a more difficult problem. About a year ago the Civil Aeronautics Board assigned to Jesse Lankford, director of its safety bureau, the task of reorganizing the rules governing air traffic, certification of pilots, and operation of aircraft.

The regulations, as they existed, were poorly expressed, badly organized and sadly lacking in any basic concept which would make them consistent and reasonable. They had grown like Topsy, and in recent years had become definitely topsy-turvy. Mr. Lankford's staff drew up a rough sketch of an entirely new set of regulations, eliminating many of the rules, and taking a liberal attitude toward all restrictions imposed upon contact flight. These "proposed revisions" were widely circulated and thousands of comments were received.

After further modification, the final recommended form of the new proposed Civil Air Regulations has been prepared and presented to the Civil Aeronautics Board for adoption.

While it is undoubtedly true that some minor changes will be made, the present proposal seems to contain in general the important rules that will govern the activities of private pilots in the future. A few slight changes have also been proposed in the Civil Aeronautics rules affecting instrument flying and commercial pilots.

For those who are interested in the new regulations, the following summary has been prepared, discussing briefly the important changes under consideration for the revised rules:

STUDENT AND PRIVATE PILOT CERTIFICATES. The statement that the applicant "must be of good moral character" has been changed to read "a responsible applicant;" requirements as to citizenship and loyalty to the United States remain unchanged.

AGE. The minimum age for a private pilot has been reduced from 18 years to 16 years. For a student pilot it remains at 16 years.

PHYSICAL EXAMINATION. No changes are indicated at present, but some important modifications are being contemplated. [See "Farewell to Superman," page 33.]

AERONAUTICAL KNOWLEDGE. The written examination now needed before the issuance of a private license will, in the future, be required previous to the first cross-country flight and will be shorter and simpler.

AERONAUTICAL EXPERIENCE. The present minimum of eight hours' dual and 35 hours' solo flight is changed to 10 hours' dual and 30 hours' solo. [For a certificate restricting the pilot to the operation of two-control non-spinnable planes, the requirement is seven hours' dual and 20 hours' solo. However, if such a pilot wishes to have this restriction removed and be permitted to fly three-control planes, he must have logged a total of 30 hours' solo—not necessarily in a three-control plane—and must receive instruction in recovery from spins]. The number of hours of dual instruction required before the solo flight is no longer specified but is left to the judgment of the instructor. Thus, a student might solo after two or three hours of dual time if the instructor considered him competent. A solo cross-country flight is still required—a minimum of three hours, a distance of 50 miles, and two full-stop landings at different fields.

AERONAUTICAL SKILL. The flight test is less strenuous. Maneuvers no longer required are: spirals, climbing turns, "S" turns, rectangular courses, co-ordination exercises, and simulated forced landings. The instructor must give dual instruction in recovery from spins but the applicant is not required to perform solo spins in the flight test. The maneuvers required are: Three 180° spot landings [one of which includes a forward slip]; a right and left 720° power turn with 45° bank; "maneuvers at minimum controllable speeds"; recovery from power-on and power-off stall entered from straight flight as well as from turns.

HORSEPOWER RATINGS. The present minimum rating of 0 to 80 horsepower is extended to read 0 to 100 horsepower. Class and type ratings are unchanged in the proposed regulations.

SPECIAL RATINGS. Practically no changes are made in the requirements for commercial pilot certificates or for instructor ratings. However, for instrument ratings, the present minimum of 20 hours' instrument instruction and practice, 10 of which must be in actual flight, is doubled, to read 40 hours instrument instruction and practice, 20 of which must be in actual flight.

PILOT LIMITATIONS. There are no changes in the privileges granted with the various grades of certificates:

The student pilot will be confined to the vicinity of his airport until he has logged at least 10 hours of solo flight and has passed the written examination on aeronautical knowledge. He may not carry any person in flight except his instructor.

The private pilot must not pilot aircraft for hire [but he is allowed to carry persons on an expense-sharing basis].

The flight instructor is restricted to eight hours of dual flight instruction a day and to 36 hours of instruction a week.

CERTIFICATES and RATINGS for MILITARY PILOTS. A rated military pilot who has been on solo flying status for six consecutive months will be granted a private or commercial certificate with appropriate class and horsepower ratings, on aircraft on which he has had at least 10 hours of solo flight within the past year, without being required to take the flight test or written examination [except for a short written test on flight rules]. This regulation has already gone into effect as of November 25, 1944.

DURATION. The student pilot certificate will expire at the end of two years; all other certificates and ratings are to remain in effect indefinitely. However, pilots may not exercise the privileges of these certificates unless they have passed a physical examination within the preceding 12 months and have met the various "recent experience" requirements, as follows:

RECENT EXPERIENCE

Student Pilot. Must have flown within three months or be checked out by an instructor.

Private and Commercial Pilot. No recent experience requirement unless carrying a passenger.

Passenger Flight. Pilot must have made five take-offs and landings within the preceding three months [for flight at night, he must have made five night take-offs and landings].

Instruction Flight. To give "certified flight instruction," an instructor must have given 10 hours of instruction within the preceding year or proved his proficiency to the CAA.

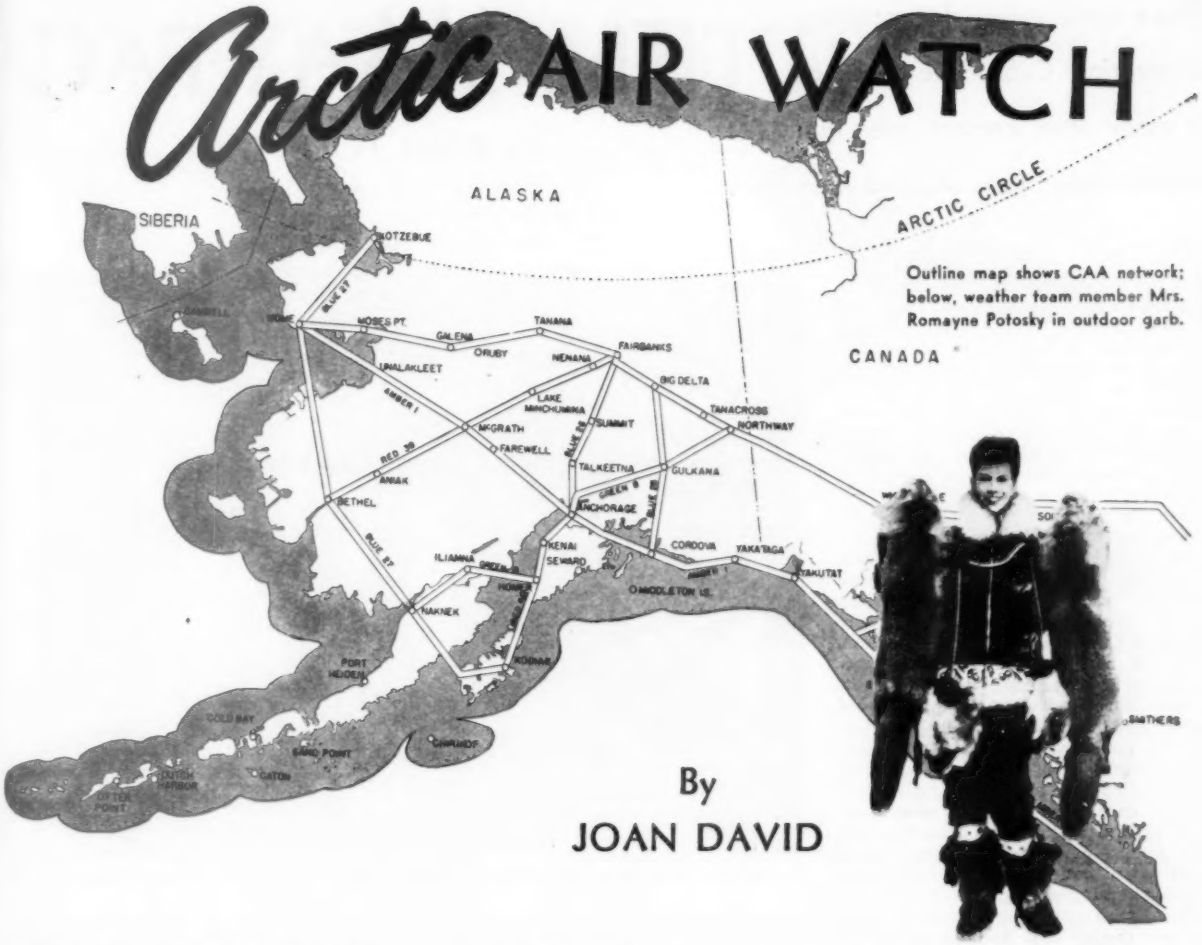
Instrument Flight. During the preced-

(*Continued on page* 120)

ABOUT THE AUTHOR

Harvard graduate, college professor of English, pilot with both seaplane and landplane ratings, the author is especially well-qualified to discuss the new regulations. His "Summary of Civil Air Regulations," is now in its ninth edition, and he has been commissioned by CAA to write the abridged text for the new private pilot examinations. Mr. Stanton is the brother of Charles I. Stanton, CAA deputy administrator, but his views do not necessarily reflect those of the CAA.

Arctic AIR WATCH



Outline map shows CAA network; below, weather team member Mrs. Romayne Potosky in outdoor garb.

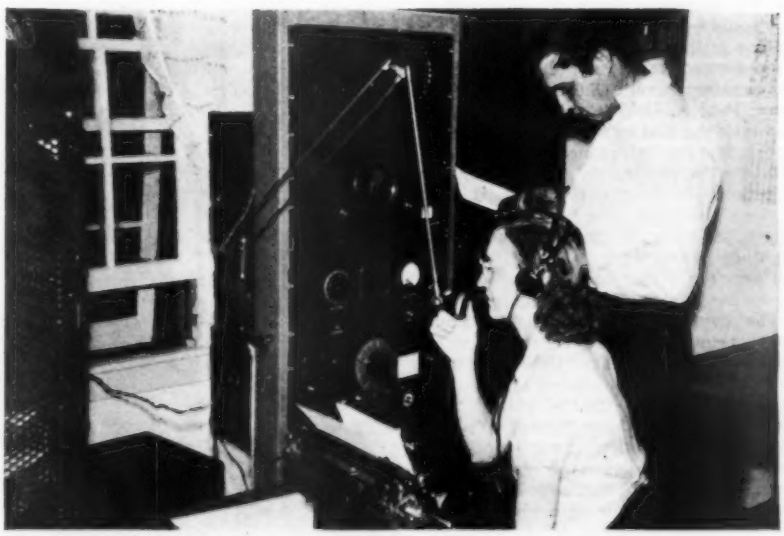
By JOAN DAVID

CAA weather teams enjoy modern life in warm and homelike cabins of lonely Arctic radio outposts.

SEVEN thousand miles of Alaskan airways that have been developed by the Civil Aeronautics Authority since 1939 are kept posted on weather by hundreds of CAA's new radio teams. It's a big job. In terms of air traffic, Alaska is already far ahead of the United States or any of its other territories. In proportion to its population the territory has 100 times as many airplanes as the United States proper. Those planes fly 20 times as many passenger-miles, carry 75 times as much airmail and almost 1,000 times as much air express and freight. Obviously, all this adds up to sizeable personnel requirements—and to even greater problems in maintaining morale.

CAA's staff in Alaska comprises more than 700 maintenance workers, pilots, inspectors, weather observers, radio operators and aircraft communicators. Most of CAA's first recruits for these jobs were bachelors. But the seven-day week, the monotony, the lack of feminine companionship, strained too many tempers. Some of the men grew scrappy, others were morose. For the few who found outdoor life compensation enough for the urban joys they had sacrificed, there were many who just couldn't adjust. Reports to CAA headquarters revealed an increasing amount of friction, little difficulties became exaggerated, there was an epi-

(*Continued on page* 110)



Phyllis and Ed Grimstead, CAA aircraft communicators on North Dutch Island, make report by radio. Operating in two shifts, they stand guard over the airways 16 hours daily.

Once used solely for artillery observation, Cubs have taken on so many other combat roles that combat troops have dubbed them . . .

The 'MAYTAG

By PAUL FOUNTAIN
Associate Editor of FLYING

TODAY lightplanes are conceded to be indispensable to ground combat operations. In the European theater they were referred to early in the war as "the eyes of the artillery," and Pacific forces adopted the Marine description "Hawkshaws of the air." But while their work is described officially as "artillery air operations," their most significant description is "Maytag Messerschmitts."

The first American artillery air operations in any theater occurred during the amphibious invasion of North Africa. On November 8, 1942, the west coast of North Africa from Port Lyautey to Safe, French Morocco, was invaded by American troops. Three Piper *Cubs* (L-4A) were flown off the carrier U.S.S. *Ranger* from about 40 miles off the coast of Casablanca to a pre-selected field at Fedala, French Morocco. Two of the three landed safely and were immediately put into use by their organizations for artillery observation. One was shot down by "friendly" small arms fire. All three planes encountered heavy antiaircraft and small arms fire from friendly ships and troops—nervous and inexperienced soldiers had not received sufficient training in aircraft recognition.

But many important lessons were learned during that first operation, according to Capt. Brenton A. Devol, Jr., pilot of one of the planes that successfully completed the mission. Original plans, he points out, called for the normal use of *Cubs* in the conduct and surveillance of fire and in reconnaissance after the landing. But there was plenty of evidence that they could be used for other purposes.

Some of these new ideas were put into effect during the five months of artillery air operations in the Tunisian campaign. Lieut. Paul A. DeWitt, one of the pilots who took the first eight *Cubs* into Tunisia, reports that the lightplanes were used extensively—in addition to regular artillery operations—in emergency transportation service, shuttling supplies to isolated ranger positions in the mountains, and for other liaison work.

It was there that commanding officers themselves first utilized the lightplane to get an overall survey of troop deployment, enemy concentrations, and effect of artillery fire. Lieutenant DeWitt reports that the general in command of his division often flew with the *Cub* pilots. "On one occasion," he relates, "I flew with him over the entire section of our front. He was getting a bird's-eye view of the whole situation. Flying over the front that far, you quite often draw some heavy fire. It's significant, therefore, to see so much brass [ranking officers] flying in *Cubs*."

Few combat casualties have occurred,

Easy to camouflage, the Cub's base for artillery operations may be any pint-size clearing.

Lightplane invasion role led to development of LST (Landing Ship, Tanks) as "carriers."

MESSERSCHMITTS'

Army's Cub has a 65-h.p. engine, an 85-m.p.h. cruising speed. It ranges 175 miles when carrying two-man crew.

General Eisenhower and Cub Pilot Capt. Eugene P. Gillespie, from whose plane the general made a survey of combat areas. Captain Gillespie piloted similar observation flights for Generals Alexander and Clark.

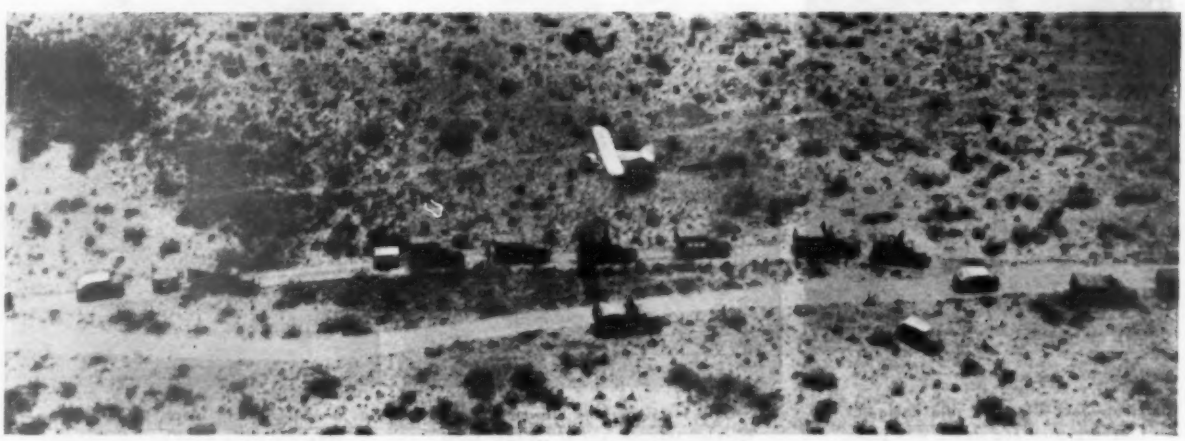
however, during artillery air operations. During the first day of the battle of Sidi bou Zid, a plane was caught in the air when enemy bombers came in followed by strafing fighters. The *Cub* pilot made a quick descent but overshot his landing strip, ending up in a grove of trees. The plane burned and both the pilot and observer lost their lives. That was the only fatal accident in artillery air operations during the entire Tunisian campaign.

The campaign emphasized not only the safety of lightplane operations, but their effectiveness as a counter-battery measure. Lieutenant DeWitt points out that "the Germans would cease firing as soon as the *Cubs* took to the air. We used them constantly from then on, adjusting fire until nearly dark each day. It was a little rough on the pilots at first but we managed to neutralize quite a bit of enemy firepower."

With aerial photography from lightplanes still in the experimental stage, other methods were devised by artillery operations units to give commanding officers graphic records of front-line developments. At dawn each morning, intelligence officers split a map into five alleys and assigned each portion to an artillery air observation pilot who then covered his territory, identifying enemy lines and noting any change in operations. Intelligence officers then put the five segments back into one map, comprising a permanent up-to-the-minute record of the situation.

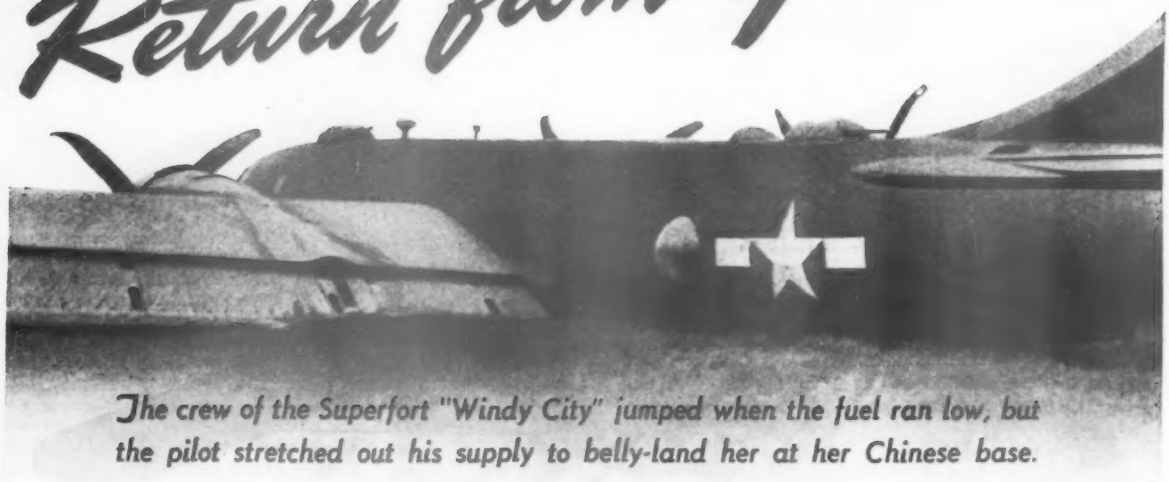
All these fortuitous developments in the use of lightplanes were combined into a detailed program for their use in the invasion of Sicily. Captain Devol sum-

(Continued on page 86)



By relaying orders via radio and loud-speaker system, Cub pilots can quickly marshal deployment of troops, concentration of supplies.

Return from Yawata



The crew of the Superfort "Windy City" jumped when the fuel ran low, but the pilot stretched out his supply to belly-land her at her Chinese base.

SOMEWHERE IN CHINA

SUNDOWN silhouetted the rolling ridges and sharp peaks ahead. The sinking sun outlined brilliantly the thunder-heads which lay between the *Superfortress "Windy City"* and its home base in western China, still many hours distant.

The pilot, Maj. Gust Askounis of Chicago, bit savagely on an unlighted cigar, his fatigued eyes studying the threatening clouds before him.

Lieut. Gordon Teach, the co-pilot, from Evanston, Ill., queried the flight engineer on the fuel supply.

In a few moments Lieut. J. W. Ward, Cul-de-Sac, Ida., replied: "We've got a chance if we get a break on the weather. My figures show we're good until 2231 (10:31 p.m.)."

The long, olive-drab bomber was returning from the 20th Bomber Command's daylight raid on Yawata, the heavily-protected steel center on the Jap homeland island of Kyushu. It had been what Air Forces men term a "hairy" mission, with daring attacks by Jap fighters and thick box barrages of flak. The *Windy City* had led a formation over the target, had shot down one enemy fighter and damaged another, and had been badly shaken by antiaircraft fire.

And now the crew was sweating the fuel supply. The long, tiresome formation flight across China, over the Yellow Sea to Japan through soupy weather, had taxed the closely calculated gas reserve.

Major Askounis said to the navigator: "Give me an ETA [estimated time of arrival] Jack."

"Ground speed and wind currents have changed," said Lieut. Jack Diamond, Cedarhurst, N. Y., almost apologizing. "My ETA is 2231."

The pilot took the cigar from his mouth. "That's a hell of a coincidence," he said coolly. "Check those figures again, will you?"

Diamond checked. He said: "Still 2231."

The men realized their predicament. The fuel would run out close to landing time. There was no margin for error.

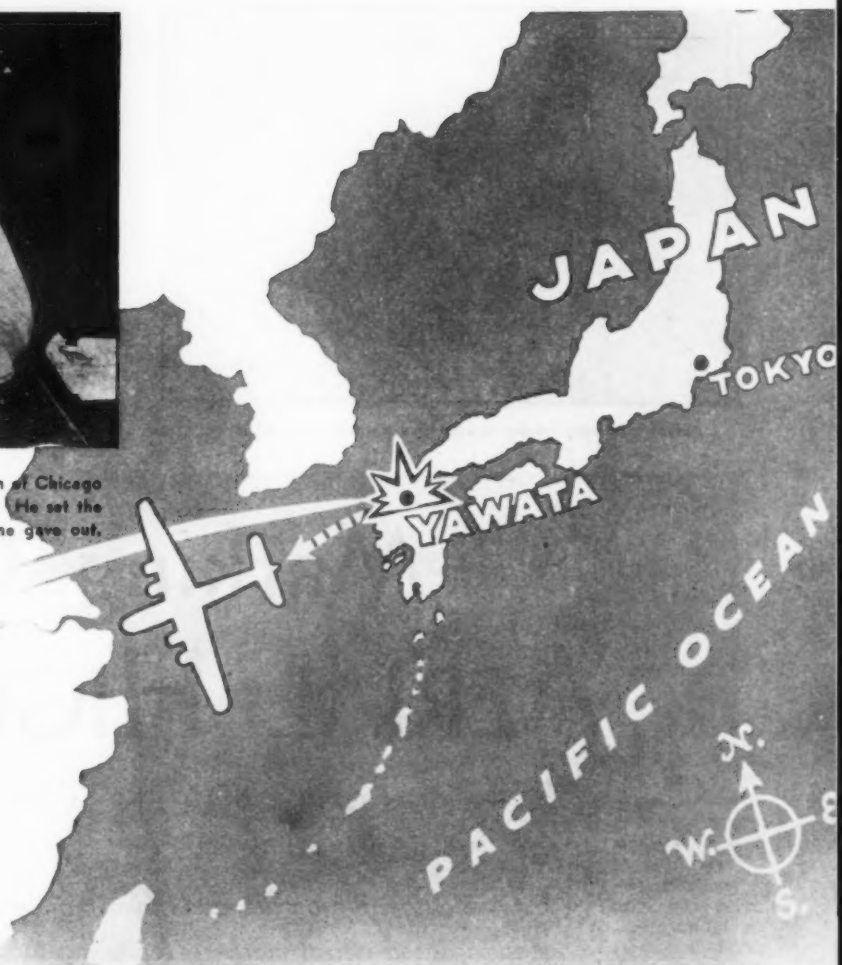
Darkness closed swiftly on the *Windy City*. In the long forward cabin hasty conferences were held. The pilot and co-pilot considered squeezing into an alternate field but, viewing the possibility of a damaged landing gear, they ruled a night landing at a strange base too risky.

Lieut. Jack Diamond, the navigator, braced himself and stayed with plane.

S/Sgts. Hassinger and Brownell. Former tumbled through roof of Chinese home.

Lieut. Gordon Teach, co-pilot, also rode the plane down on crash landing.

Maj. Gust Askounis, the pilot, for whose home town of Chicago the *Windy City* was named, in characteristic pose. He set the plane down for a crash landing just as the gasoline gave out.



The navigator and engineer worked out the most economic let-down from altitude that would enable them to clear the mountains ahead.

The radio operator, T/Sgt. William Mann, Richland Springs, Tex., began calling for a position pickup. He was unable to contact the home field though, strangely, a field on the India side of the "Hump" was coming in clear as a bell.

"Sugar Fox, Sugar Fox from Two Five Three, Two Five Three," he called. "Give us a QDM. Over."

Major Askounis used the interphone to inform the men in the rear of the plane.

"We're running out of gas, fellows," he said calmly. "Be ready to jump if I give the signal. You've been briefed on bail-out procedure. Follow that plan and you'll be okay."

Sergeant Mann kept calling. "Sugar Fox from Two Five Three. If you don't give us that goddam QDM in 10 minutes we're bailing out!"

The *Windy City* was 40 miles north of the field at 6,000 feet when Mann received a heading of 335°. Major Askounis began to turn the plane on course.

Lieut. J. R. Rutledge, the bombardier, stayed with the plane during landing.

Then someone shouted: "There it is! Over there! The field beacon!"

As swiftly as hopes were raised, however, they were dashed. The fuel pressure on No. 4 engine was dropping rapidly.

The engineer said: "We're losing No. 4!"

The pilot said: "Okay."

One down, three to go.

The *Windy City* nosed towards the field, letting down a few hundred feet a minute. The plane was about four miles from the field when Major Askounis realized a normal landing was impossible. Mann still was unable to contact the tower. Other planes were landing, and to enter the traffic pattern now would endanger them.

The pilot's headset was plugged in on command frequency. He looked over at Lieutenant Teach, who was on intercom, and said: "Bail 'em out."

"Co-pilot to all crew members," Lieutenant Teach called. "Bail out!"

Altitude reading indicated the *Windy City* was about 2,500 feet from the ground. Major Askounis banked the plane to the left so that the men in the rear, who were jumping from the right side of the plane, would be able to clear the stabilizer.

The senior gunner, S/Sgt. Fred Brownwell, York, Pa., was first to jump. After starting the "putt-putt" (auxiliary generator which would give added power to lower the landing gear) he took his place at the head of the line. He crouched low in the doorway and forced his way out against the adhesive slipstream. His parachute pack caught on the door. The men behind gave him a shove and he tumbled free of the plane. He tugged at the ripcord. Nothing happened. He pulled again, with all his strength. This time the 'chute opened with a jerk and a pop. He landed in a dry rice paddy . . .

The engineer said: "No. 1 is out."

The pilot said: "Okay."

Two down, two to go and the plane was still in a turn. S/Sgt. Edward Mertz, Indianapolis, the left gunner, landed hard in a roadside ditch. A shooting pain in his leg made him cry out. He tried to walk but couldn't. His leg throbbed dully. He sat down and began shouting for help.

The *Windy City* continued to turn. Major Askounis tried to lower the nose wheel to enable the men in the fore cabin to plunge through the front well. But it wouldn't let down. The bombardier, Lieut. J. R. Rutledge, Fayetteville, Tenn., his parachute buckled, jumped up and down on the nose wheel, trying to dis-

(*Continued on page* 150)

Giant shrubbery marker is expensive but extremely effective.

Desert markers should be metal, mounted above drifting sands.

Marking Our AERIAL HIGHWAYS

By HELEN ASHBY

Washington Staff Correspondent, United Press

CAA-sponsored program adds longitude and latitude to the new standardized aerial markers, replacing those blacked out by war.

THE United States system of air markers —which consists of orientation symbols painted on roofs and sides of buildings and on highways and water towers—may become a world-wide boon to private pilots as a result of recommendations recently adopted by the International Civil Aviation Conference at Chicago.

The conference, adopting a committee report setting forth the standard American marker as a model for other countries, said such air guides should be placed wherever necessary to determine aircraft position, and specified that "every city and town may be marked."

The air marker, which is now recognized as standard for this country and is expected to serve as the pattern for an international system, is more complete than markers erected before the war. The major difference is that symbols for latitude and longitude have been added.

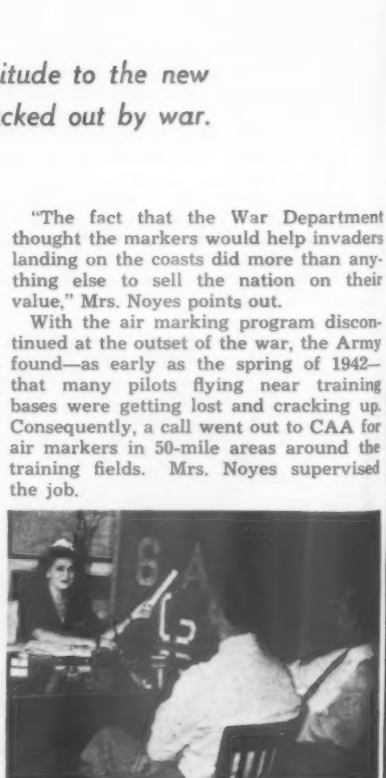
Today's air marker includes the name of the town in which it is located—or the nearest town, if the marker is outside city limits—latitude and longitude in degrees and minutes, an arrow pointing true north, and another arrow pointing toward the nearest airport having paved runways. Special symbols may be added to direct pilots to air parks. Letters and symbols, with a few exceptions, are chrome yellow on a black background. Ten feet is the minimum height for letters on roofs of buildings and ground markers must be at least 20 feet high.

The United States already has far more air guides for private flyers than other countries but is only "off to a good start" toward providing an adequate system of markers throughout the country according to Blanche Noyes, Civil Aeronautics Administration specialist in charge of air marking. The CAA-sponsored program to install air markers began in 1935 under Mrs. Noyes' guidance, and 30,000 markers were completed by December, 1941. A veteran pilot, Mrs. Noyes has flown more than 100,000 miles in connection with her work.

The program to erect air markers was halted soon after Pearl Harbor when the Army ordered all markers removed along the east, west, and gulf coasts. Nearly 2,500 markers—representing six years' work—were blacked out in six weeks under Mrs. Noyes' direction with labor crews provided by the Army. But the wartime setback was not without benefit to the marker program.

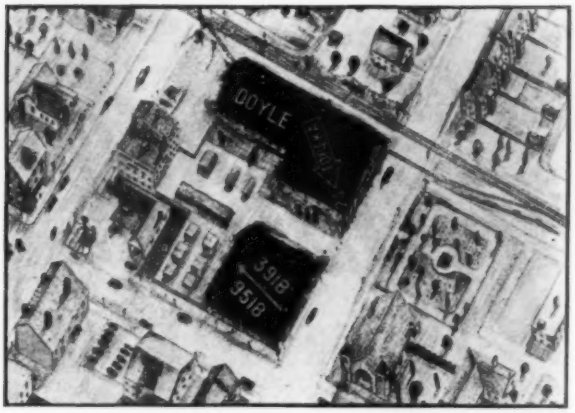
"The fact that the War Department thought the markers would help invaders landing on the coasts did more than anything else to sell the nation on their value," Mrs. Noyes points out.

With the air marking program discontinued at the outset of the war, the Army found—as early as the spring of 1942—that many pilots flying near training bases were getting lost and cracking up. Consequently, a call went out to CAA for air markers in 50-mile areas around the training fields. Mrs. Noyes supervised the job.

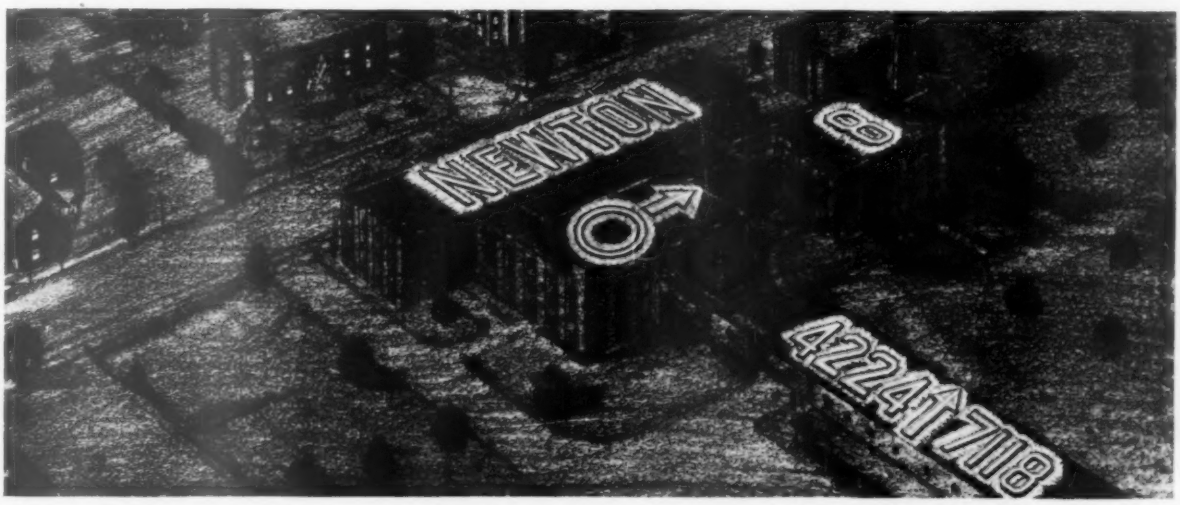


CAA air marking specialist, Mrs. Blanche Noyes, explains use of letter templates.

A number of markers have already been installed on highways.



Roof tops are ideal but must be big enough for 10-foot letters.



Huge neon-lighted markers would be excellent for night flying, but require careful maintenance in all weather.

Air markers went up in 50-mile areas around Alabama's Maxwell Field, Thunderbird and Falcon Fields in Arizona, Langley Field in Virginia, and scores of other training fields in Texas, North Carolina, Florida, and other states.

The program calls for markers in every town and village. Cities require several markers, at least one on each side of the city. Mrs. Noyes believes that a projected goal of 100,000 markers throughout the country is "far too conservative" to meet the needs of private pilots.

"Air markers mean to private flyers what the nation's highway signs mean to automobile drivers—there can't be too many," Mrs. Noyes says. In order to speed the installation of aerial highway signposts, she gives technical assistance to interested local groups on request. Complete directions for erecting markers are contained in the CAA Air Marking Bulletin No. 12, available on request.

Pre-war aerial marker painted on roof will need latitude and longitude added.

WPA funds were formerly allocated for the national air marking program, but no federal funds are now available. Financing is now a function of state aeronautical associations and local groups—Rotary clubs, pilot clubs, and business groups.

CAA is now marking the roofs of its hundreds of range and communications station buildings in accordance with the new system as a maintenance job, and state and local groups are undertaking their own programs with the CAA extending technical assistance when needed.

Amelia Earhart was the original sponsor of the federal air-marking program. She and Phoebe Omlie, another aviation pioneer now with CAA, devised the program and Miss Earhart sold it to the Government on the theory that private flying must be made safe before it could become popular with the average citizen.

Thus, in 1935, a nation-wide air marking program was launched under sponsorship of the old Bureau of Air Commerce. WPA labor and funds were used as were contributions of state aeronautical commissions, committees, and local groups. Some 30,000 markers were sprinkled through all states in the six years preceding Pearl Harbor at an average cost of about $100 per marker. They went a long way toward eliminating the widespread practice of buzzing railroad depots to peer at the names of towns placed under eaves, a direct cause of numerous crack-ups, injuries, and deaths.

As a result of intensive studies during the past three years, post-war signposts will be much better than pre-war. Inclusion of latitudes and longitudes enable pilots to "pinpoint" their locations and make it possible for the air marking system, as known in the United States, to be used internationally. An improved type of block lettering has been devised for increased visibility. International orange and white, and a variety of other colors, including silver, have been used for markers in the past. But chrome yellow on black, which can be seen from 3,000 feet,

(*Continued on page* 144)

Striking photograph of a weather front over Iceland, typical of the scenes encountered almost daily by Atlantic weather squadrons.

Atlantic WEATHER REPORT

By KURT RAND

Weather surveys made by USAAF crews maintain maximum safety for year-round operation along North Atlantic air routes.

HOW can we obtain accurate weather data about the vast spaces in the middle of the Atlantic where storms can die out, maintain themselves, or intensify, without revealing their behavior to forecasters on either side of the ocean?" That was the question asked—and answered—by officers of a USAAF weather reconnaissance squadron during the past two years. What they learned during the course of their investigation makes it fairly certain that scheduled operations along North Atlantic air routes—particularly flights from east to west—may never again be drastically curtailed during winter months.

The method used was simplicity itself. They equipped aircraft with special meteorological and navigational instruments, put a trained forecaster-observer aboard as one of the crew and sent them out over the North Atlantic routes.

From that calm appraisal of the problem grew a carefully-planned weather reconnaissance project which has proved that year-round operations in the North Atlantic are practical. Military pilots traveling the short northern routes between the United States and Europe are now putting the new flight technique developed during the weather hops through its first exhaustive tests.

Here is the first complete account of the history-making project, as told by Lieut. Robert A. Doremus of the Eighth Weather Squadron and Lieut. Charles D. Brewster of the First (formerly the 30th) Weather Reconnaissance Squadron, who are attached to the North Atlantic Division of the Army Air Transport Command:

Early in 1943 the 30th Weather Reconnaissance Squadron was organized for the specific purpose of safeguarding movements of military aircraft over the northern routes of the Atlantic. The squadron was equipped with a number of *Mitchells* stripped of their armament and provided with bomb bay fuel tanks and a few special meteorological instruments. The bombardier's "greenhouse" made a perfect observation post for the meteorologist, and the speed, range and service ceiling of these airplanes were admirably suited to weather reconnaissance over these medium distances.

The routes extended in jumps of from

Converted Flying Fortress over Greenland's wastes on scheduled reconnaissance flight through the North Atlantic weather fronts.

700 to 800 miles, from Presque Isle, Me., through Labrador, Greenland and Iceland to far northern Scotland. The squadron operated continuously throughout the summer and fall of 1943 and flew a total of 1,100 hours in all kinds of weather.

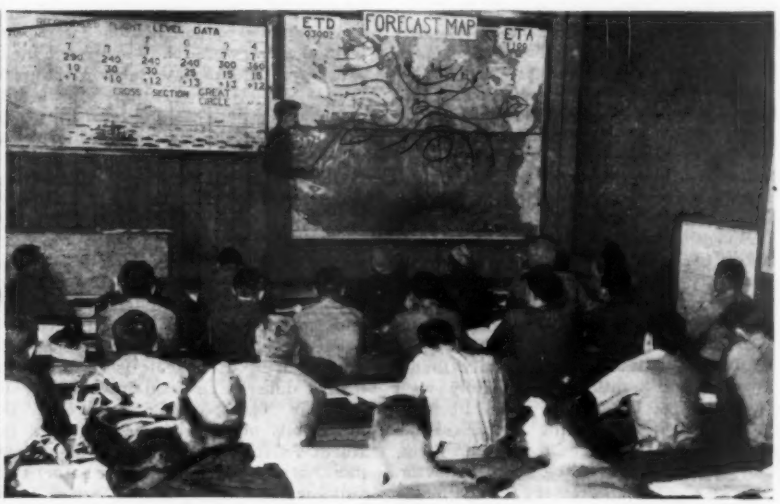
These planes were essentially pathfinders for ferrying movements of military aircraft. They took off well in advance of a projected flight and radioed back frequent reports on weather along the route. From such information ground forecasters could construct a cross-sectional chart of the atmosphere, making a copy for each pilot about to fly the same route.

As a further guide for the control officers responsible for planning such flights, a reconnaissance plane nearing the end of its trip would radio a coded message summarizing the state of the weather in terms of the kinds of planes which could safely fly in it. For example, "pursuit craft in formation" (requiring extremely favorable condition), or "individual experienced pilot" (requiring much less favorable conditions). By such means the routes were used to their capacity without unnecessarily endangering the lives of the crews—though none of the flights were picnics since risk could never be entirely avoided.

The AAF project was not, of course, the very first weather reconnaissance work on the North Atlantic. To provide forecasters with information necessary to plan the operation of fighter aircraft in the Battle of Britain and of bombardment craft in the growing attacks on the continent, the British established reconnaissance flights westward over the ocean. Each day planes took off from bases on the coast, flying westward, southwestward and northward, measuring pressure, winds and temperature and charting the cloud systems and storms and returning to their stations. The reports from such flights could be used on the daily weather maps just like land reports. And they measurably increased the accuracy of forecasts for Britain and the continent at a time when accuracy was of enormous importance. Similar flights later were based on Gibraltar, Iceland and Nova Scotia. Some of the original routes are now being flown by American personnel in American planes.

Meanwhile, the 30th Weather Reconnaissance Squadron was preparing to expand its operation with additional *Mitchells* and a flight of *Flying Fortresses* and also to shift the emphasis in the type of work done. This change was progres-

Observers check weather reconnaissance reports, then "weather-proof" air schedules.



ATC pilots, co-pilots and navigators are briefed at Newfoundland, prior to transatlantic take-off, with weather facts gleaned from vast network of reconnaissance flights.

Typical North Atlantic weather crew (left to right), Radio Officer Theodore Skoglund, Pilot Jack Catchings, Flight Engineer Jack Miller, Co-pilot Arthur Passoei, Navigator Lawrence Regan. Catchings, Passoei and Regan were crew members of the original weather plane "Icicle."

sively away from reconnaissance (designed for the clearance of transoceanic air travel over one prescribed path) toward scheduled daily flights along routes that covered the Atlantic's most doubtful weather areas. The information from such flights (patterned after the British method) is used not so much to clear specific movements of tactical aircraft as to supplement the data used in drawing weather maps and analyzing current weather systems. Well-drawn maps and accurate analysis enable the meteorologist to forecast weather for several routes rather than for just one.

These synoptic flights were arranged to produce information for both the 10,000-foot chart and the surface map drawn by forecasters. Time of flights is chosen to coincide with established map dates. Aircraft fly out from their bases along predetermined routes, sending reports at prearranged positions every 100 miles; the trip out is made near 10,000 feet and the trip back near the surface, or vice versa.

For the most accurate reports, it is necessary to fly as close as possible to the level for which information is desired. One flight, for example, makes its surface observation from an altitude of 500 feet above the waters of the North Atlantic—it must fly 800 miles at this low level.

Toward the end of 1943 route reconnaissance around the northern rim of the Atlantic had almost ceased for the winter. Of course, British reconnaissance flights covered the weather immediately west and north of the British Isles but there were vast spaces in the middle of the ocean where storms could maintain themselves without revealing their behavior. Yet is was still necessary to fly heavy bombers from Newfoundland and Labrador to Britain all during the winter.

It was also necessary that at least a few cargo aircraft be kept in operation over similar routes. Their only other route was through the Caribbean and the relatively circuitous paths of the South Atlantic. The projected synoptic flights of the 30th Weather Reconnaissance could not reach the center of the ocean. How could this gap in the weather data be bridged?

The solution was to use the cargo planes themselves. Most of the load capacity of a *Skymaster*, for instance, could be devoted to fuel, so that its range became enormous—enough to span the North Atlantic in either direction in any but the very strongest headwinds. Their service ceilings of 25,000 feet would enable them to climb over most storms. These aircraft were designed for long-distance flying and trained crews were ready to operate them.

A plan for experimental winter operation of *Skymasters* was therefore put into operation. There were several purposes: first, to prove the feasibility of operating transport aircraft over existing North Atlantic routes in the winter; second, to prove that such operation would be practical with regard to the useful cargo carried and the time involved; third, to answer questions concerning operational procedures, flight techniques, instrument development, meteorological research, and special equipment that might be needed to effect a safe and reliable operation; fourth, to collect useful meteorological data to be used immediately by the Air Transport Command for the movement of tactical aircraft over the North Atlantic route during the winter months, as well as to gather weather data suitable for later analysis. The aim was to meet both immediate and long-range needs.

Three standard Douglas *Skymasters* were assigned to the project—four-engined craft whose wing fuel tanks were supplemented by extra tanks within the fuselage that doubled fuel capacity. The planes were operated by American Airlines, Transcontinental & Western Air and the Air Transport Command.. The airline planes were based respectively at LaGuardia Field and Washington, D. C., and were operated by airline personnel. The ATC plane was based at Presque Isle, Me., and flown by Army Air Forces personnel. To each plane were assigned two Air Forces weather officers of the Eighth Weather Squadron, especially trained to observe weather from the air, the two men making alternate round-trip flights. The eastern terminus of each hop was Prestwick, Scotland.

The two airline planes generally flew from their bases to Newfoundland, then directly across the ocean, aided by prevailing westerly winds. They returned directly if wind and weather permitted, or by way of Iceland (sometimes Greenland) or, if necessary, along the North African-U. S. route. The Wing plane more commonly flew by way of Labrador and Iceland, with occasional stops in southern Greenland. Thus, all North Atlantic routes were covered in achieving the four-fold purpose of the missions.

To achieve other objectives originally set up—development of techniques and instruments and the gathering of meteorological data—these three aircraft were provided with special equipment. They contained, in addition to the usual pressure altimeter, a radio altimeter measuring absolute height above terrain. Each had a new and secret radio aid to navigation, making possible the determination of a plane's position to the nearest mile, day or night, without sight of the stars or earth surface. There were aerographs whose three pens recorded—on a drum rotated by clockwork—the barometric pressure, temperature, and humidity of the air outside the plane. An especially accurate pair of mercury-bulb thermometers secured wet and dry bulb temperature readings.

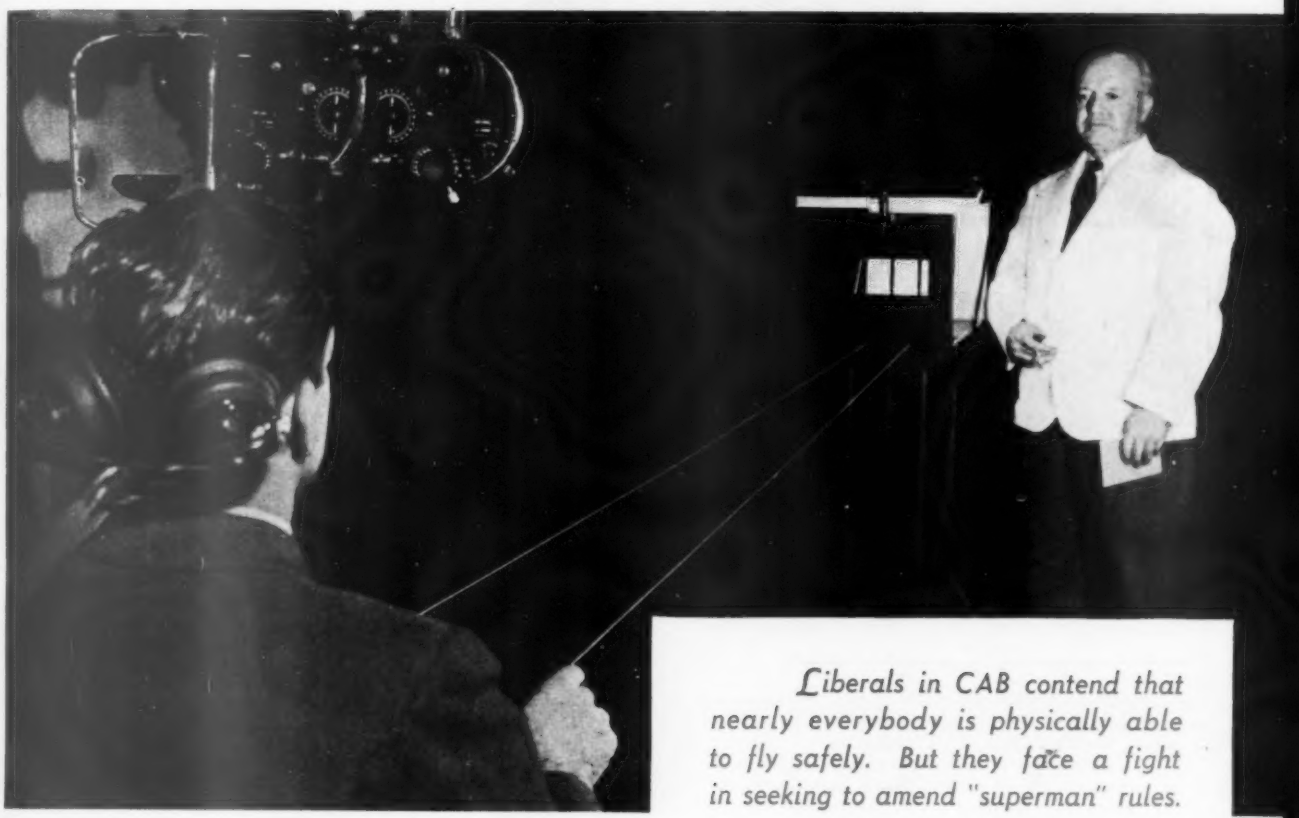
This and similar equipment subsequently installed on planes of the 30th Weather Reconnaissance Squadron compiled the most accurate information ever collected on winter weather over the North Atlantic.

The aerograph was chiefly useful in providing a continuous record of temperature and humidity. Its record of pressure indicates whether changes in temperature and humidity were due to changes in altitude of the airplane or to actual differences in the air mass through which the plane was flying.

It was originally planned to use two thermometers, one dry bulb and one wet bulb, to determine humidity at any point. The aerograph uses the expansion and contraction of human hairs to measure moisture. Such a hair hygrograph, besides being a notoriously sluggish and fickle instrument, requires, when exposed to a 200-m.p.h. airstream, certain corrections which are but imperfectly understood. Unfortunately, the wet bulb also requires corrections and failure to find

(*Continued on page* 140)

Farewell to SUPERMAN



Liberals in CAB contend that nearly everybody is physically able to fly safely. But they face a fight in seeking to amend "superman" rules.

Depth perception test. Is it all-important in pilot physical examinations?

By FRED HAMLIN

Washington Editor of FLYING

SUPERMAN, the darling of old-time pilots and regulatory experts, is being elbowed from the cockpit of the American private plane to make way for Mr. and Mrs. Average Citizen of the post-war flying world.

Optimists say that his complete elimination will be consummated any day now. Less sanguine liberals point out that while the difficult business of changing other regulations to make sense took a year, the impossible task of changing the medical rules may take a little longer. On the other hand, it's coming soon—to make a flat statement, sometime in 1945.

These facts and surmises are based on work now being completed by the Civil Aeronautics Board, law-maker for the pilot, and the Civil Aeronautics Administration, Federal enforcement agency when the laws go on the books. CAB Vice Chairman Edward P. Warner, one of the prime movers in streamlining medical and other regulations, sums up the work:

"On the basis of public opinion voiced to the Board during 1944 and on resulting reforms drawn up here in Washington, this year—1945—will see the private U. S. pilot freed once for all from old-time regulatory red-tape in all departments. Medical requirements, perhaps one of the most flagrant offenders and certainly subject of the most sustained protests from pilots, typify the way the changes are being made and how they came about."

Proposed revisions in physical requirements for a pilot are undeniably drastic. No longer will the amateur pilot have to pass stringent examinations, re-pass them at too-regular intervals and generally be at the mercy of arbitrary and irrelevant rules and of the medical examiners who had to follow CAA requirements.

The tentative new set-up is based on the conviction that almost anybody is physically qualified to fly and that he should be required to go to the least possible trouble to prove it. There are, of course, exceptions, but they are few.

"We feel strongly that a man with reasonably good eyesight should be permitted to fly if he is free of physical disabilities which will not be likely to incapacitate him suddenly and without warning—like a serious heart condition or epilepsy," says Jesse Lankford, director of the CAB Safety Bureau and a long-time running-mate of Warner.

"Reasonably good eyesight" in the new rules will mean, not a technical, academic eye test, but an actual demonstration in flight of what the applicant can do with his eyes regardless of ostensible physical limitations. Better still, if you are an amateur seeking a physical permit, you can get it from your family physician instead, as was formerly so often the case, of going miles out of your way to await the pleasure of a CAA medical examiner."

As the Warner statement would indicate, it is generally agreed that Mr. and Mrs. Average Citizen, themselves, are responsible for discrediting the idea that it takes a physical colossus to fly a light-plane. The end of a battle that dates back to before the last war and has continued unabated to this day was in sight only when public opinion—including that of leaders in the industry and the majority of pilots and potential pilots—flooded the CAB with requests that red tape rules and arbitrary enforcement procedures be eliminated.

Much credit accrues to the Board for bringing the long-drawn debate to a head. Far from discouraging criticism, the Board has invited it. More than a year

THEY WOULD EASE PHYSICAL EXAMS.

Edward P. Warner

Dr. Dean R. Brimhall

Jesse Lankford

THEY TAKE A STERNER VIEW.

Dr. W. R. Stovall

Dr. A. J. Herbolsheimer

ago, revisions were proposed by Messrs. Warner, Lankford and associates, as well as by L. Welch Pogue, CAB chairman. The public was urged to make suggestions, submitting them to the Board by March 15 of last year [FLYING, April, 1944]. Further revisions were made in line with the resulting suggestions and again the public was invited to comment.

Included in these comments were pros and cons from Government officials, aviation organizations and private individuals. Most noteworthy was a book-length analysis of the evils of the old rules and a list of recommended changes which was prepared for the Aeronautical Chamber of Commerce by Wolfgang Langeweische, private pilot who had long crusaded against the inhibiting regulations. Significantly, Langeweische's statement on the old medical requirements was one of the most brief in his report. Get rid of them, he recommended—they're not only outmoded but they put anybody who tries to enforce them on the spot.

Behind these commentaries were marshalled a devastating set of investigations inspired and in part written by Dr. Dean R. Brimhall, CAA's Director of Research, encouraged wholeheartedly by Warner and Company.

Brimhall and Warner have been anti-authoritarian and pro-experiment on the medical regulations since 1930, when Brimhall was a fixed-base operator in his home state of Utah. Even in those days Warner was questioning medical examination problems.

Brimhall quoted Warner as saying nearly 15 years ago:

"Most of us non-medical men, and that applies to the laymen as opposed to the membership of any profession, are very unwilling to accept anything on anybody's authority. We don't like to be told a thing is so because it is so, or because somebody said so. We want some kind of proof . . . of the level at which physical requirements should be set."

No adequate proof was then forthcoming. Not until nearly a decade later, did Brimhall, on taking his present CAA post in 1938, begin asking for data. When it was not forthcoming, he began to assemble it himself. He went back to the beginnings of aviation medicine to find it and what he uncovered was, in many cases, devastating evidence. It was assembled recently for the edification of the Board reformers—and for the confusion of the conservatives.

The seed which developed into the medical regulatory tree he found, was planted in July, 1914, by Col. Sam Rever, then head of the Aviation Section of the Signal Corps which was later to become the AAF. Reber had been asked to set physical standards for airmen. Flying blind from an admitted lack of aeronautical knowledge, he got together with colleagues and drew up the requirements.

"The results," drily comments Lieut. Col. C. L. Beaven, later commandant of the School of Aviation Medicine at Randolph Field, "were a little surprising," the standards being "so high that no applicant was able to pass." These standards were subsequently toned down, but not very much.

Later, when we went into the war, U.S. physicians consulted with British doctors with battle experience and came back with a report that was eventually distorted to read that 65 per cent of the fatalities of British airmen were owing to physical defects—another "fact" that Brimhall exploded as having no basis whatever in the record. Its true source: mere hearsay from harried British medics in front-line duty.

But this statement, plus the toned-down regulations that few men could pass, formed the basis for the physical requirements that were written for private pilots. Dr. L. H. Bauer was put in charge of their enforcement when they went on the books in 1926. Few changes had been made when the Board started its reform a year ago.

Perhaps the strongest statement against one aspect of the old examination difficulties is by a doctor, Col. Harry G. Armstrong, now with the AAF medical corps and one of the outstanding authorities in the field. In his "Principles and Practices of Aviation Medicine," published in 1939, Armstrong points out that "the greatest weakness in the examination for flying is not the standards as set by regulations but in the manner in which the examination is conducted. Instances of total blindness in one eye and frank psychoses have been known to escape the notice of examiners and this could only have occurred from gross neglect or carelessness."

This was confirmed by one of the Brimhall investigations made in corroboration with Raymond Franzen, his research consultant, on variations in examinations by CAA medics. The research showed that there was a "great deal of disagreement between physicians examining pilots on successive occasions with six months or one year interval. The hazard of being noted with a given defect depends upon the physician who does the examination," and "standardized tests and standardized methods of examination are essential."

Using the records, he and Franzen found in another project that "Pilots in the commercial class with visual or hearing defects are *less* likely to have an accident than are those free from the defects." Also, "the difference in respect to the other defects is so small as to be negligible . . . commercial pilots having other defects being equally, but certainly not more likely, to have accidents than are normal pilots in this class."

It was also pointed out that "of some 60,000 accidents in the records of the Civil Aeronautics Board, analyzed and collected over a period of 18 years, there is no indication that the cause of any of them can be proven to be attributed to or associated with the physical condition of the pilot as determined at the time of his accident." The quotes are Lankford's.

As CAA director of research, Dr. Brim-

(*Continued on page* 114)

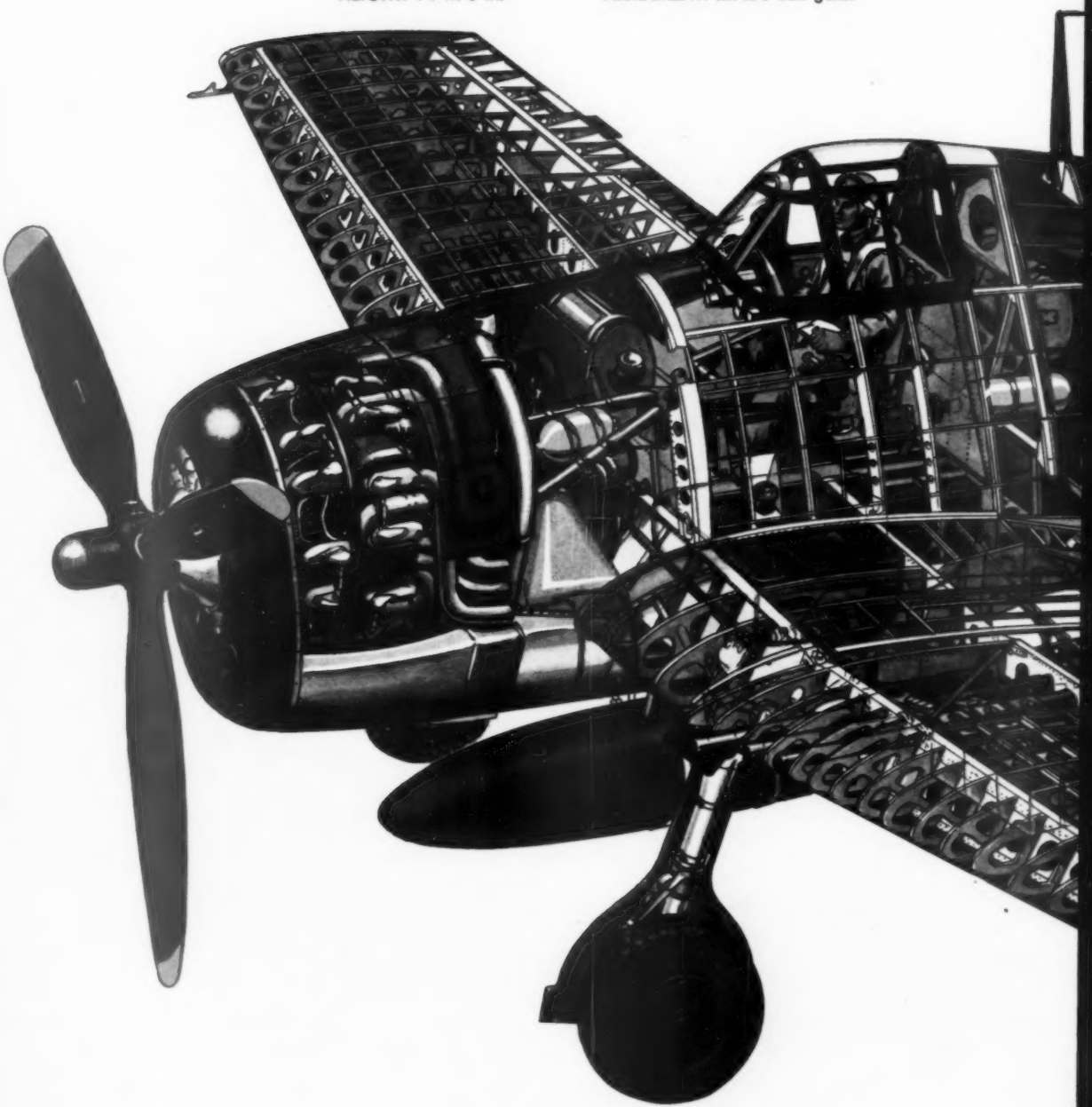
FLYING's cutaway drawing this month is the Grumman Hellcat, on the insert at right.

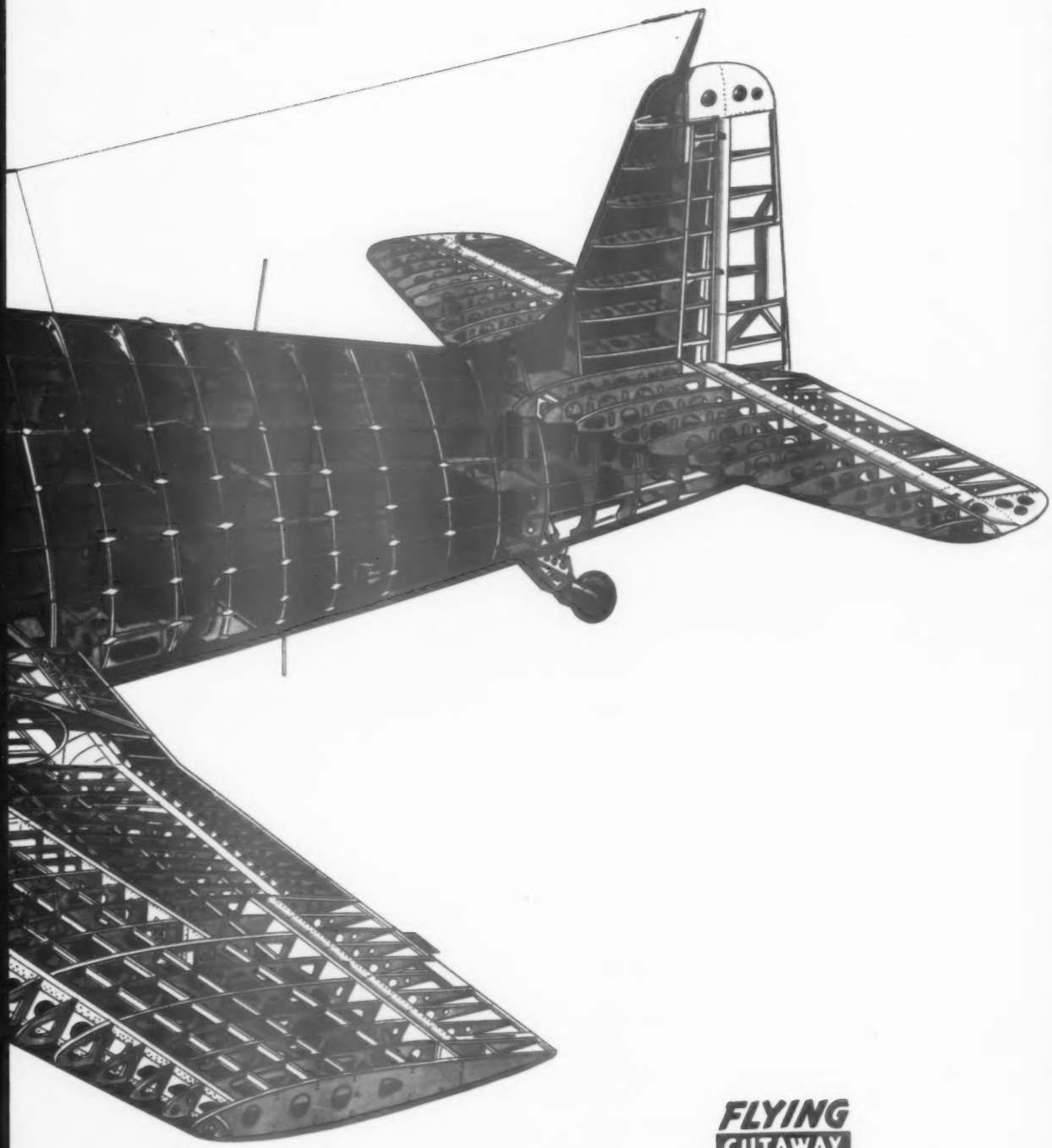
GRUMMAN HELLCAT
(F6F-5)

One air-cooled Pratt & Whitney R-2800 engine, 2,000 h.p.

WING SPAN: 42 ft. 10 in.
LENGTH: 33 ft. 6⅝ in.
HEIGHT: 14 ft. 5 in.

TOP SPEED: about 380 m.p.h.
CRUISING SPEED: about 260 m.p.h.
ARMAMENT: six .50-cal. guns.





FLYING CUTAWAY

by

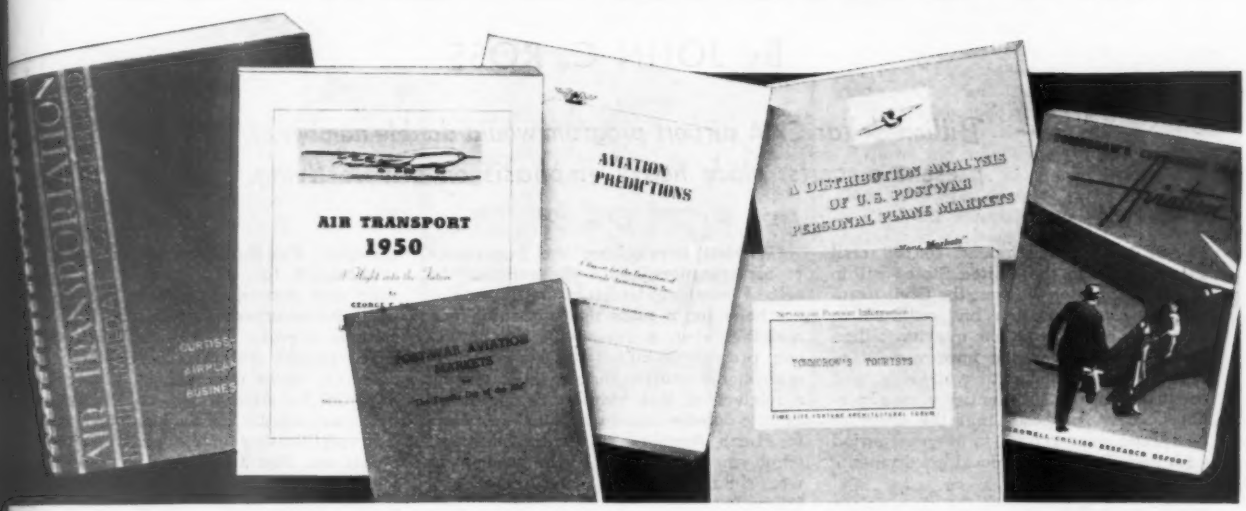
R. G. SMITH

MORE VIEWS OF THE HELLCAT

ALMOST from July 26, 1942, when it flew for the first time, the *Hellcat* has been a clean, "bug"-free airplane. It is one of the war's first airplanes to be designed to the specifications of a large group of fighter pilots, who were polled by Grumman officials before the design was begun. The version shown here is that currently in production, the F6F-5. The night fighter version is the F6F-5(N). In reality, the *Hellcat* is a fighter-bomber; it can carry two 1,000-pound bombs. It also is equipped to carry rockets. Major external differences between the F6F-5 and its predecessor, the F6F-3, are slightly modified engine cowl flaps and the deep, almost blue-black overall color of the F6F-5.

This is the cockpit of a Hellcat of the British Fleet Air Arm. Note gunsight above instruments.

There's a Prediction For It



Just a few of numerous books, reports and surveys that give inconsistent predictions on the future of post-war aviation.

By LAWRENCE KEIL

How can the man in the street have a clear idea of aviation's future when even the experts, who have made studies of the subject, disagree?

WHATEVER your curiosity about the future of aviation, there's a prediction for it. And whatever your ideas or your prejudices about that future, there's one to match yours. Aviation authorities, utilizing research, opinion and crystal-gazing, have come forth with a mint of prophecies. Some are gloomy and some are rosy. They have but one point in common: they seldom agree.

For example, how many planes will there be post-war? What are your choices? 450,000? 300,000? 100,000? 35,000?

Ralph S. Damon, vice president of American Airlines, compares the number of licensed aircraft before the war with the number of licensed motor boats—30,000 as against 300,000. Based on this he predicts that the post-war number of privately owned planes may easily reach the magnitude of licensed motor boats prior to the war. He reasons that the close of the war will release 10 times as many flyers and mechanics as existed before and that the factory personnel engaged in the manufacture of airplanes will bear approximately the same ratio.

A post-war private plane increase of four- or five-fold is forecast by S. Paul Johnston, Washington representative of Curtiss-Wright, now on leave with the U. S. Navy. He estimates the market will build up to 20,000 new units a year five years after the close of the war.

Another optimist is A. A. Kucher, director of research, Bendix Aviation Corporation. He estimates that four years after the war there will be 300,000 registered personal planes in this country, and compares the airplane output in that period with our automobile production in 1908. Mr. Kucher qualifies his predictions with the assumption that people will have money to spend for airplanes and that the hoped-for improvements in reliability and safety will be realized.

Charles I. Stanton, Civil Aeronautics Deputy Administrator, joining the most consistent seers, also foresees some 300,000 civilian planes in active service within four years after the war.

This tremendous market, says Stanton, will come from those owning their own planes prior to the war—augmented by the tens of thousands of pilots and aviation specialists who will return home from the armed forces—plus our present growing generation of boys and girls.

William A. M. Burden, assistant to the secretary of commerce for air, believes we may have 450,000 privately-owned aircraft at the end of the first post-war decade.

He qualifies his remarks with the assumption that necessary improvements, an intelligent Government policy for the promotion of private flying, and removal or modification of complicated regulations which have deterred widespread use of airplanes will all become realities.

In the next few years there will be 100,000 private planes. This is the opinion of Grover Loening, aircraft consultant to the War Production Board and widely-known engineer.

One more glowing vision for the future is presented by the research department of Crowell-Collier Publishing Co., which provides the results of a four-months' survey.

The survey offers a figure of 100,000 persons in urban areas who would like, or expect, to own their own airplanes after the war. An additional 200,000 upper-income urbanites indicated that aircraft were second on their list of purchases when and if they become available.

In direct rebuttal to the gleaming prospects outlined so far is the statement by E. E. Lothrop, manager, statistical and research department, Aeronautical Chamber of Commerce. He estimates that only 9,500 private planes will be manufactured during the two years following the war's end—and of these 2,500 will be helicopters.

Another dissenter is Pennsylvania-Central Airlines' president, C. Bedell Monro. He believes the private plane possibilities have been grossly exaggerated, both as to numbers and use.

Oddly enough two leaders in the small plane field, William T. Piper, president of Piper Aircraft and William D. Hall, chief engineer of Aeronca Aircraft, are unwilling to predict definite figures.

(*Continued on page* 130)

AIRPORTS for EVERYBODY

By JOHN C. ROSS

Billion-dollar CAA airport program would double number of present airports, place heavy emphasis on private flying.

BASED on an estimated 400,000 civil airplanes in the United States within 10 years after the war, the Civil Aeronautics Administration has outlined to Congress a one and one-quarter billion dollar program for the improvement of 1,625 of the 3,000 existing airfields, and construction of 3,050 entirely new airports. CAA proposes that the program be spread over a five- to 10-year period with both Federal and local governments sharing the costs.

Here is a summary of the proposal:

The CAA estimates that the United States will require 6,305 airports to serve the private and commercial flying needs reasonably expected to develop five to 10 years after the war.

To accomplish this, CAA would continue 1,630 airports as they now exist; improve 1,625 existing airports, and build 3,050 entirely new airports.

At completion of the program there would be one or more airports at 5,269 locations in the United States, compared with 2,585 places that now have landing areas. County coverage would be increased from 53 to 88 per cent.

Great emphasis is placed on personal flying—2,900 of the 3,050 new airports would be especially adapted to personal aircraft. Approximately 4,000 airports would be in towns under 5,000 population.

The reasoning behind this policy is explained as follows:

"Without overlooking the importance of air transport," says the report, "the sale of personal aircraft offers the brightest hope for a mass market which will maintain even a reasonable fraction of our present 20-billion-dollar-a-year aircraft manufacturing industry. Preserving a nucleus of this industry is important both to defense and the national economy, for it can provide a substantial source of employment in peace, and the weapons of war should we ever need them in a hurry."

The whole program is designed to correct deficiencies in the U. S. airport system. CAA now has a record of 2,942 civil and military airports in the nation plus 313 not now usable for various reasons. But these are so distributed that only 53 per cent of the counties in the United States now have one or more landing areas. Towns of less than 25,000 population show the greatest lack of airport facilities. On completion of the program, however, about 5,500 of the contemplated 6,300 airports would be in towns up to that size.

Of the 286 places approved for air carrier service (101 are suspended during the war), 140 do not meet the desirable minimum of 5,000-foot paved runways. In addition, many have inadequate taxiways, parking and servicing aprons, an insufficient number of runways for the normal variation of winds, and obstructed approaches. For the 678 locations named in applications for certificates of convenience and necessity pending before the Civil Aeronautics Board, only 93 have suitable airports.

The airport system is particularly deficient in cities over 500,000 population. Statistics for cities in this category show that there are 438,585 persons per airport.

In justification of its program, CAA points out that the airport is the basic facility of aviation just as the highway is the basic facility of automomotive transportation. "By investing 25 billion dollars in roads during the past 25 years we have made it possible for the United States to become a nation on wheels . . . For a much smaller investment, we can start the United States on its way toward becoming a nation on wings . . ."

That investment is estimated at $1,021,567,945, exclusive of land or airport buildings. Land values will vary with the location, but it is estimated that the cost of the additional land and airport buildings, not including hangars, would be approximately $230,000,000—making a total cost of about $1,250,000,000.

The cost would be shared between Federal and state and local governments. The exact proportion each would be called upon to bear is not definitely set forth, but the report calls attention to the "good precedent for the proportionate sharing of costs . . . in the public roads program

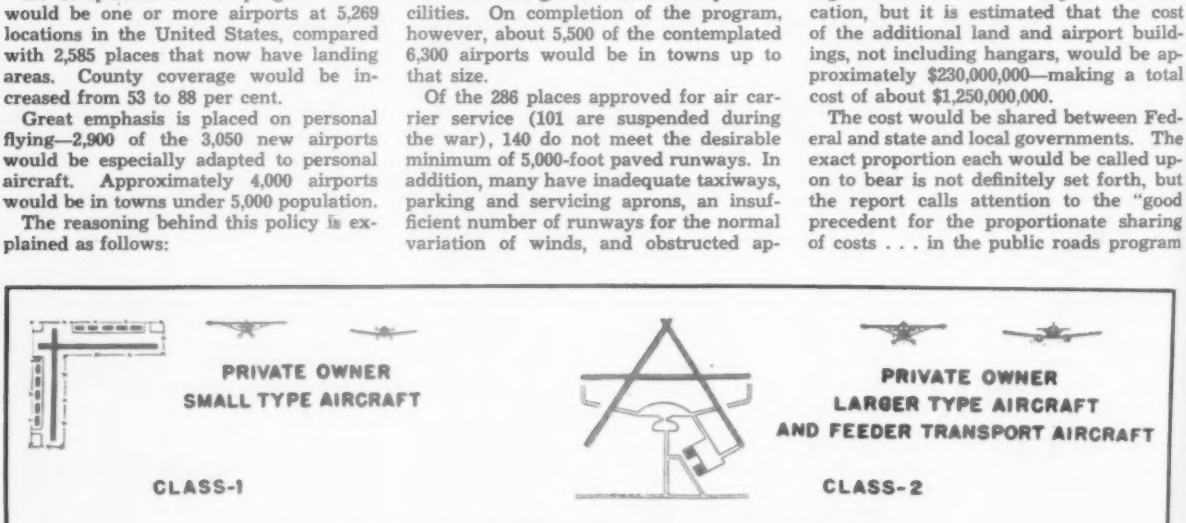
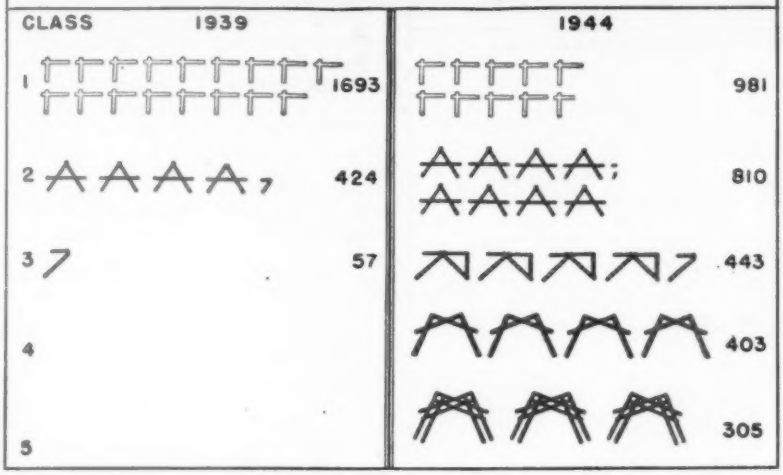


Figure 1. CAA AIRPORT CLASSIFICATION SYSTEM

(See table on adjoining page for specifications)

Figure 2. HOW AIRPORTS HAVE GROWN IN FIVE YEARS
(Each Symbol Equals 200 Airports)



which has operated satisfactorily for many years on a 50-50 basis."

Congress is asked to authorize not to exceed $100,000,000 in Federal aid annually for the airport program, and to make available immediately to the CAA $3,000,000 for further preparatory work so that the program can start as soon as the construction appropriation is enacted.

CAA urges that any Federal aid airport project be required to meet the approval of the CAA administrator on scope of development, cost, conformity with CAA standards for location, layout, grading, drainage, paving and lighting, and be subject to CAA inspection.

To obtain national uniformity, the Federal-aid act would set up certain requirements for the states.

Each state would be required to (1) establish an official or an unofficial body equipped for carrying on its share of the program, (2) have zoning-enabling legislation to protect airport approaches, (3) have legislation enabling local governments to participate in Federal aid through the states, (4) have no special tax on aviation facilities, fuel, operations, or businesses the proceeds of which are not used entirely for aviation purposes, (5) insure that all public airports within the state will operate in the public interest without unjust discrimination or unreasonable charges, (6) insure proper operation and maintenance of all public airports within the state, (7) make Federal-aid airports available for the unrestricted use of U. S. Government aircraft without charge other than an amount sufficient to cover the cost of damage done by such aircraft, (8) require installation at all Federal-aid airports of a standard accounting and fiscal reporting system.

Airport sponsors would be required to enter into contracts with CAA guaranteeing the proper maintenance and protection of airports and their operation in the public interest.

Airports in the program are classified according to the CAA system which is illustrated in Figure 1. Generally, Class 1 fields are suitable for lightplanes; Class 2 for larger type private owner aircraft and smaller transport planes used in local and feeder services; Class 3 can accommodate present day twin-engined transport planes, and Classes 4 and 5 will serve the largest aircraft now in use or planned for the immediate future. The table below gives detailed specifications for the five classes of airports.

The airport plan provides detailed information on each airport scheduled for improvements. CAA emphasizes, however, that the plan is tentative and will require revision from time to time to adjust it to current needs as aviation develops in the post-war period. In formulating the plan, population was used as the primary basis of airport distribution. The suggested class of airport was determined by the relative importance of the locality as a center of a trading area, its function in the national airport system and its importance to existing and proposed air routes. In areas of high population density, airports were located to give maximum utility.

Figure 2 illustrates the enormous strides in airport construction made in the past five years. Class 2 airports have increased from 424 to 810; Class 3 from 57 to 443; and Classes 4 and 5 from none to 403 and 305 respectively.

So important has been this construction, in fact, that only 30 new Class 4 and 12 new Class 5 airports would be constructed under the Federal aid plan, though a number of others would be improved, as indicated by Figure 3. Figure 4 shows the number of projects by CAA regions, though it is not broken down into classes of airports.

Figure 5 illustrates the number of existing and proposed new airports by size of town. Although the largest number of new airports will be Class 1, the total expenditures will not be correspondingly large because of lower unit cost of such airfields. Heaviest expenditures will be for Class 2 airports, which will take nearly half of the total.

Expenditure for new airport facilities will be about three-fifths of the total; the remainder will be for improvement to existing facilities. Eighty-three per cent of the money will be in communities of less than 50,000 population, though this allocation is still tentative.

When Congress requested the study which called forth recommendations outlined here, it asked that the report "include provision for clearing and protecting the approaches to such landing facilities."

In so doing, Congress recognized the danger that airports built with Federal monies may be made partially or wholly unusable by obstructions in the surrounding area. For example, if an airport is built with a 5,000-foot runway—and later a building 100 feet high is erected at the end of that runway, the effective length of the runway will be reduced to only 2,000 feet.

CAA safety standards provide that there must be no object in line with the runways for two miles from the airport, the height of which measured level from the landing area is more than 1/20 of its distance from the end of the runway in the

AIRPORT SIZE PLANNING STANDARDS

Recommended Minimum Standards	Class I	Class II	Class III	Class IV	Class V
Length of landing strips in feet*	1,800 to 2,700	2,700 to 3,700	3,700 to 4,700	4,700 to 5,700	5,700 and over
Width of usable landing strips	300 ft.	500 ft.	500 ft.	500 ft.	500 ft.
Length of runways in feet	none	2,500 to 3,500	3,500 to 4,500	4,500 to 5,500	5,500 and over
Width of runways in feet	none	150 night 100 day only	200 inst.** 150 night operations	200 inst.** 150 night operations	200 inst.** 150 night operations
Number of landing strips aligned with prevailing winds***	70%	75%	80%	90%	90%

* Based on sea level conditions. One surfaced runway of dimensions shown above is recommended for each landing strip for airports in Classes 2, 3, 4 and 5.

** Instrument.

*** Landing strips and runways should be sufficient in number to permit take-offs and landings to be made within 22½° of the true direction of winds four m.p.h. and over for percentage shown above. Development of tricycle landing gear may change this standard.

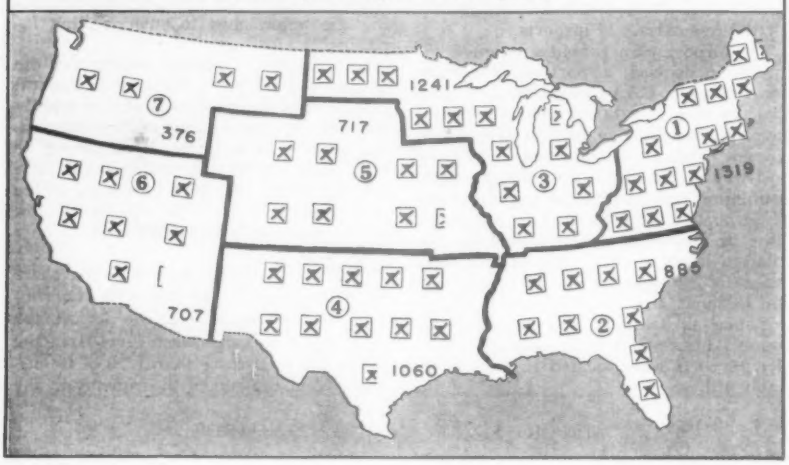
Figure 3. AIRPORT DISTRIBUTION BY CLASS

(Each Symbol Equals 200 Airports)

CLASS	EXISTING	TO BE IMPVD. (a)	NEW AIRPORTS	TOTAL AFTER COMPLETION OF CAA PLAN
1	1148	303	1806	2597
2	869	699	1101	2198
3	478	349	101	654
4	447	213	30	520
5	313	61	12	336
	3255	1625	3050	6305

Figure 4. PROPOSED REGIONAL DISTRIBUTION OF AIRPORTS

(Each Symbol Equals 100 Airports)



away on a "shelf" of public works plans for use only in a period of widespread unemployment, the report nevertheless offers the following facts to support the value of the program for public works:

1. *Employment.* It would provide a total of 1,250,000 man-months of temporary employment. After the airports were constructed, using the "conservative average" of 10 employees per airport, the system would furnish continuous employment to 63,000 persons directly, not considering their effect on employment in aircraft manufacturing and allied industries.

2. *National Defense.* The airports would help build up a reserve of civilian pilots and would serve as potential military bases.

3. *Community Use.* The airports would bring speedy air transport to the business and industry of a community and open up air mail and air travel facilities to all residents. They would serve as bases for personal aircraft.

4. *Permanent Value.* The value to the community and to the national economy would increase with the years.

5. *Private Investment.* Federal funds would be used for only 50 per cent of the landing areas and buildings essential. Private funds would be attracted immediately for aircraft maintenance and sales, services, flying schools, restaurants, etc.

6. *General Health and Safety.* Each additional landing area increases the safety of flying and benefits a growing section of the population. The non-flying public is protected by the operations of rescue and emergency aircraft.

7. *Transport Cost.* Longer runways will increase payloads and decrease operating cost of commercial aircraft.

"To realize the maximum economic and military benefit to our country from the vast potential of private flyers," asserts the survey, "the utility of the airplane must be increased. This calls for airports near the potential flyers' homes or places of business, and near recreation areas, national parks, and other places to which they might want to fly. Location of small airports today usually is determined by low development cost rather than convenience to the inhabitants of the communities they serve . . .

(*Continued on page* 126)

case of Class 1 airports, 1/30 for all other categories and 1/40 when the runway is used for instrument landings.

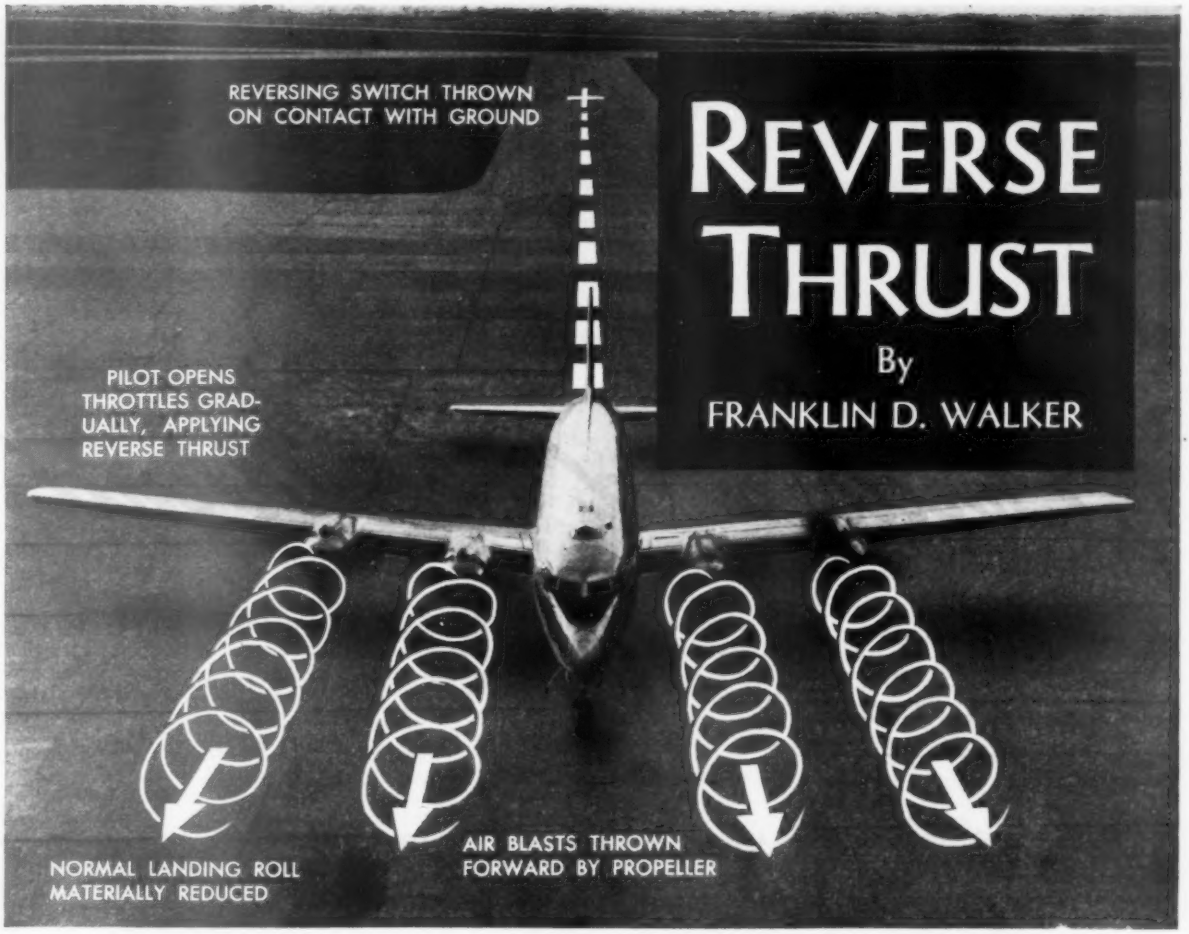
Because of this situation, CAA recommends that any Federal aid program for airport development which Congress may authorize should include the cost of approach clearing and protection in the construction cost. Another condition urged on the grants-in-aid program is that the states and local units enact zoning laws restricting the height of structures or objects in the vicinity of public airports. Twenty-eight states and territories have airport zoning legislation of some sort, 13 of which have the model act prepared by the CAA and National Institute of Municipal Law Officers.

Declaring that a national airport system is so essential that it cannot be laid

Figure 5. AIRPORTS BY SIZE OF TOWN

(Each Symbol Equals 100 Airports)

TOWNS	EXISTING NO.	ADDED BY CAA PLAN NO.	TOTAL
50,000+	395	150	545
25-50,000	206	59	265
5-25,000	972	515	1487
- 5,000	1682	2326	4008
	3255	3050	6305



REVERSE THRUST

By FRANKLIN D. WALKER

Picture illustrates effect of reverse thrust in reducing landing roll. Churning props throw air forward, braks plane.

Exploiting reverse thrust may increase landing speeds, reduce wing loading, cut runway lengths.

THE *Fortress* crew climbed aboard the big plane parked with its nose only a few feet from the outside wall of a large hangar. As the last member entered the plane, an Army officer hurried over from the hangar door and shouted: "We'll have you hauled away from there in a few minutes."

"Oh, don't bother," replied the crew member, as he closed the door of the plane.

With the officer standing open-mouthed on the ramp, one engine of the *Fortress* kicked over. Soon all four propellers were whirling. Then, while the officer watched in bewilderment, the plane slowly backed away from the hangar, swung around and taxied toward the end of the runway to await take-off clearance.

The big plane's ability to back away from the hangar without the aid of a tractor was a graphic demonstration of one use of reverse propeller thrust as applied to multi-engined land planes.

But while reverse thrust will, for the first time, permit large land aircraft to be backed into loading and unloading ramps, it will have its widest application in post-war years as a braking device. Jack H. Sheets, chief design engineer, and Gordon W. MacKinney, installations engineer, of Curtiss-Wright's Propeller Division, believe that "all future large aircraft designs will incorporate aerodynamic braking, by means of reverse thrust from propellers, for use during landings."

The significance of this accomplishment should not be underrated. It could, for example, vastly decrease the lengths of commercial runways, especially in difficult terrain. Or conversely it could increase landing speeds, thus opening the way for completely new aircraft of tremendously high wing loading and hence much higher speeds. By reducing deck run, the development might also affect landing characteristics of carrier-borne aircraft or of carriers themselves. In contrast with wheel braking, airscrew braking becomes more effective as speed is increased.

The use of reverse propeller thrust as a brake on multi-engined land planes, as developed by Engineers Sheets and MacKinney, is the most recent application of this well-known device which has given satisfactory service on routine operations of multi-engined flying boats for about two years.

(*Continued on page 102*)

Experimental installation of reverse pitch propeller for use on Fortress. Experiments show uses for warplanes.

Birds and the Wind

Designed by Nature to utilize the wind on long-distance flights, birds have inspired much of man's progress in his conquest of the airways.

Material contained in this feature is based largely on an article written for Bird-Lore magazine by Capt. Neil T. McMillan, of Eastern Air Lines. Log Magazine and the book Why Men Can Fly, by M. K. Chapin, also were used in research for background material.

AFTER all, it was the birds that started this flying business. Leonardo da Vinci, Lilienthal, the Wright Brothers and other pioneers of human flight got their inspiration directly from study of birds. Regardless of the progress in aviation that has stemmed from man's own ingenuity, most of the more practical developments—new aircraft designs, more economical air routes, even such things as radar—might well have been based on proper understanding of the sparrow, the duck, the bat.

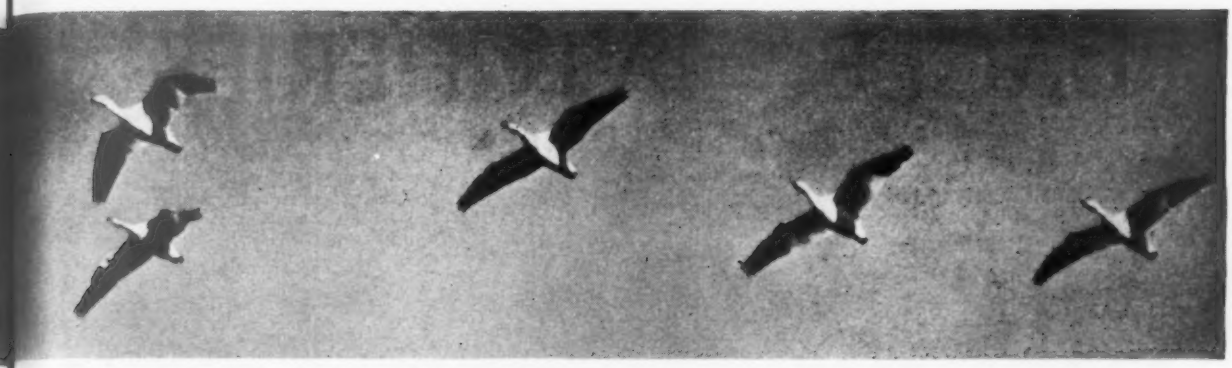
Man did a lot of experimenting, for instance, on air cargo carriers before he devised an economical flying boxcar like the Fairchild *Packet*. But Nature had emphasized right along that the weight of a flying creature should be concentrated amidships below the level of its wings.

The superiority of hollow tubing over solid bars—tremendously important to airframe designers—might have been discovered at any time in history that man took time to examine closely the leg bone of the duck he had for dinner.

For hundreds of centuries the flying bat has employed "natural radar" to avoid colliding with trees and other obstructions in night flight. The little animal emits a constant stream of high-pitched cries which, upon striking any object in its flight course, are reflected back in time to warn the bat of impending collision.

There is reason to believe that, as man approaches what appears to be certain limits in aircraft construction and design, there are still some unguessed facts about flying that birds may supply. Particularly is this true with respect to the use the bird makes of the wind.

Their "knowledge" of the airways enables birds like this herring gull to perform amazing flights with small expenditure of energy.



Man has much to learn about navigation and flying economy from snow geese (above) and other migrant flocks that "ride the wind."

Of course, if there were no wind, the day of the mechanical navigator would indeed have arrived. Without drift the plane need only be pointed at its destination and in easily and precisely computed time it would get there. But because of this one factor, that wind may carry a plane off course, the whole complex of navigation theories and procedures has been developed. Celestial astronomy, techniques of pilotage, the complexities of radio and electronics—all have been developed and taught to air navigators simply because there is wind.

All this lends pertinency to the fact that there is probably no other living creature that knows quite as much about wind as does the bird. Wind is the major factor in its life. Its range and habits are controlled by the use it can make of wind. During migration, it is wind that sets bird routes and schedules and is the primary cause of delays and accidents. A bird will not fly any great distance without its aid; whenever possible, it rides the wind.

Because his own work is so largely controlled by wind, the pilot is certain to regard both it and the bird in a different way than the average ornithologist who does the major part of his investigation at the bottom of the great ocean of air. Neither the ornithologist's view nor that of the pilot is likely to be wholly correct—and in between the two views is a whole field of study where little or no investigation has been made.

It is a bit curious, however, that learning to fly should have taught men so much that they did not previously know about bird flight—and that the little they have already learned makes it even clearer than ever before why men must fly by use of their minds, not their muscles.

In an article written for *Bird-Lore* magazine, Capt. Neil T. McMillan, of Eastern Air Lines, suggested that migrating birds put forth no more energy than they must—that they need not fight wind and storm because they ride the winds. Of course, the migrant's flying schedule is far more flexible than that of an airliner. Even so, Captain McMillan's study of birds and their use of the wind is worth detailed consideration by every pilot. It is at least significant that a non-stop flight can be made by a lightplane on the wings of a northerly gale with an increase of speed and economy of fuel comparable to that achieved by the amazing flight of the golden plover.

A flying bird, Captain McMillan points out, is essentially a part of the wind. Actually it cannot be struck by wind any more than a man can be struck by the automobile in which he is riding. A balloon floating in an air current may move with respect to the earth at 50 m.p.h., but the flag on its halyards will hang in a dead calm. It is the air that is moving, not the balloon. And, while a bird cannot float like a balloon, it can accomplish the same result at the point where its own air-speed is sufficient to give it enough lift to balance gravity. The bird moves through the air while the air itself moves. It feels pressure only in ratio to its own air speed as it moves up-wind, down-wind, or cross-wind.

In short, Captain McMillan's contention is that the wind must be understood as a means of transportation—not a propelling agent. But, through countless generations of living on the surface of the globe where two elements—air and land, or air and water—are in collision, man has come to associate wind with a pushing force that could vary in intensity, from a caressing breeze to a destructive tornado. It was only when he learned to fly that he found his old conception of the wind was wrong. A flying creature is carried; it is never pushed or blown.

Only in collision can moving air exert pressure. Such collision can occur with the earth and objects attached to it, or it can occur when a moving air mass meets air moving in a different direction. Changing from one such current to another is analogous to a man stepping from an escalator moving in one direction to another moving in the opposite. There is a distinct shock which is gone as soon as the change has been made. Dirigibles have been literally sheared apart when straddling strong opposing air currents—even birds have been injured under like conditions. Apart from this consideration, wind must be thought of as relative motion. An object that is entirely surrounded by an air current—whether it is raindrops, bird or airplane—cannot be struck by the wind because there is, quite literally, no wind.

When we think of air currents, rivers of air, east or west wind, most of us still assume—quite erroneously—that the earth is stationary and that the air moves across it. Even many of our meteorologists still use the Beaufort scale which measures the "force" of wind on this assumption. But Copernicus taught us long ago that the heavens do not revolve around a stationary earth. Both are in motion. And, at the very latest, we should have learned from Einstein and the relativists that when two mediums are in motion it is incorrect to assume that one moves while the other is stationary.

Actually, the earth spins as a solid with a constant angular velocity. Except for two arbitrary places at the poles, any point on the earth moves in the same direction and through the same number of degrees of a circle as any other point in the same given interval of time. The atmosphere, however, spins as a fluid. Al-

(*Continued on page* 122)

Huge wingspread of the great blue heron makes possible its slow, effortless flight.

EAGLE HATCHERIES

By HAROLD KEEN

Aviation Editor, San Diego Tribune-Sun

Corsairs and Dauntlesses at the Mojave, Calif., Marine Corps Air Station. The Tehachapi mountains form a picturesque backdrop.

Chain of Marine west coast camps takes trained flyers and ground crewmen and welds them into combat teams.

Col. William J. Fox, Guadalcanal veteran, commands Marines' largest station, El Toro.

ABOVE the deserts and coastal plains of Southern California eagles are soaring. They are fledglings of the new Marine Corps air stations at El Centro, Mojave, Santa Barbara and El Toro.

Green youngsters, led by combat-wise veterans, are trained here in a systematized method of feeding new Marine squadrons into war zones for reinforcement and replacement.

Col. Lawson H. Sanderson, former group commander at Santa Barbara, was operations officer of the First Marine Air Wing which fought off the Japanese during the invasion of Guadalcanal. He sums up the Guadalcanal lesson by these words:

"We had to learn from bitter experience how long a man could endure conditions that confronted us late in 1942 and early 1943. Pilot fatigue was aggravated by the extra strain the flyers always were under. Malaria, dysentery and all the other jungle diseases put our men on the shelf. There was a limit to the endurance of even such workhorses as Joe Foss."

Replacements finally began to come, and by the time Col. William J. Fox, first commanding officer of Henderson Field, returned to the States early in 1943, he saw the project for providing those replacements, which he had initiated the previous spring, well under way. Stations had been established with an initial $35,000,000 appropriation at El Centro, Mojave, Santa Barbara and El Toro. Fox himself was given the command of El Toro.

West Coast Marine aviation was a modest enterprise before the war, concentrated at the San Diego Naval Air Station. Today, just one of its four training bases—that at El Toro, near Santa Ana—has more traffic than any other field in the west, including the Navy's mammoth San Diego station.

Marine Fleet Air, West Coast is now the largest of all Marine aviation organizations. But even in full operation its air stations have been pushed hard to keep pace with the many growing needs which develop as time passes.

Each of the four stations has contrasting conditions. El Centro is 54 feet below sea level in the irrigated Imperial Valley. Runway temperatures at midday rise as high as 130° and skin will blister in contact with metal. In the winter water freezes in buckets left outside overnight.

Mojave is also on a desert flatland 220 miles north of El Centro, but at 2,700 feet elevation. These desert stations have distinct weather advantages. There is virtually no fog and very little rainfall.

Though pilots perspire freely, their shirts remain perfectly dry. "Playboys at Palm Springs at the edge of the desert pay $20 a day for weather like this," a Mojave officer declared.

Santa Barbara and El Toro stations are back on the coast and cannot boast of continuous fog-free, cloudless days. But Lieut. Col. C. V. Burnett, station commander at Santa Barbara until recently, calls the weather "ideal for South Pacific training. We get fog at odd hours, ceilings are likely to be at wide variances, and overcast may start to blanket the field unexpectedly. Then our flyers learn how to poke their way back, much as they are called upon to do overseas."

Marine Squadrons are no longer rushed for replacements as they were when the Hellhawk Squadron was sent into action when its pilots had had only 10 hours in their combat *Corsairs*.

Camp Miramar, near San Diego, is the funnel through which flows the personnel about to be formed into a compact fighting team. It is the first Marine landfall on their return to the states. Ground crew members also come to Miramar.

Here the men from combat areas are given thorough physical and mental examinations by Naval Medical Corps doctors. Those who need rest and rehabilitation are marked for special treatment. Some are classified as ready for further duty immediately. These are given 30 days' leave and then ordered to report to one of the fields described previously.

Col. W. J. Wallace (now Brig. Gen.) formerly headed Marine Fleet Air, West Coast.

Meanwhile another group is being processed at Camp Miramar. These are youngsters who have just received their wings, and ground crew men who have completed training and are ready to join a squadron. These groups too are sent to the eagle hatcheries.

Soon the experienced hands and the cub pilots begin assembling at the station and the squadron takes form. During the first few weeks planes have not yet arrived in appreciable quantities and the outfit spends its time with lectures, familiarization with regulations, and orientation to the surrounding area in advanced trainers.

Within two months after arrival, the squadron has become a closely-linked fraternity. Now the group enters its so-called flight syllabus which includes stunting, formation work, aerial combat, navigation, gunnery strafing, instrument flying, carrier landing practice, bombing, night flying. On the ground the men go through tedious hours of recognition training, Link Trainer instruction, and the use of various other synthetic training devices.

Then come the advanced phases most likely to be demanded in combat areas. After four to six months of this the squadron is ready for combat. There is scuttlebutt of impending departure. Men become restless as the dates for embarkation are constantly changed. It's really a relief when finally the order to "shove off" is received.

For a year or more, interspersed with several periods of rest and recreation at rear bases or in New Zealand or Australia, the Marine flyers will claw at the enemy. Meanwhile, other fledglings will be taking to the air at the "eagle hatcheries." END

Women Marine reserves now stationed at all of the Marine training fields do office work, manage traffic control, and handle many of the synthetic training devices. This is a typical group photographed in front of El Centro's line-up of Corsairs.

Jobs for Veterans

"A lot of us in the services," writes an armed forces reader, typical of thousands who have been flooding us with letters recently, "are financially able to get into post-war aviation, but now our hands are tied. This goes for starting a business at a commercial airport, organizing an airline, feeder airline, non-scheduled or fixed-base operations, or school. What can be done to prevent non-military individuals and established airlines from sewing up all post-war flying? Is there any way of getting a straight answer to their question?" . . .

There are a number of things that can be done, now or later, to meet civilian competition. To put it more optimistically, if you do these things—other factors being equal—your chances against a non-veteran in any given competition are about 60-40 your way. But it is and will be competition; don't let anybody kid you.

. . . as Employers

If you plan to boss your own business, there are a number of enterprises in which you might invest. Running an airline or a feeder is one, albeit the most difficult and perhaps the most competitive. You will be faced almost immediately with difficulties, including civilian competition. . . .

First move is to pick your route and file your application with the Civil Aeronautics Board. Get going now—today. For details write to C. Edward Leasure, CAB chief trial examiner, a veteran of the last war so acutely conscious of veteran problems that he sits up nights writing answers to queries from the armed forces (he's getting them by the hundreds, too). . . . His address is Civil Aeronautics Board, Department of Commerce, Washington, D. C. After you've filed your application, there will be some delay until applications from other candidates are assembled. Then—and this is your toughest hurdle—all applicants will be invited on a given date to come to a hearing on their various claims in Washington. This is an expensive and time-consuming business, since somebody has to be there in person to represent you. But it *can* be done by men at war, because it *has* been done. Norsemen Air Transport, proposing a domestic feeder route through New England, applied not long ago. The organization is made up entirely of fighting men, all in uniform, but they had enough ingenuity to get some of their number at the hearings. Others can delegate friends, relatives, or other legal representatives.

. . . as Employees

Another optimistic note is sounded by the Board: most feeder airline franchises probably will not be granted until after the war. Non-scheduled operations will be delayed (not because of the Board, but due to the plane shortage) and, to a lesser degree, so will fixed-base operations and schools. Concerning these last two, the competition will be local. If you're interested in going into this type of activity, best move is to get somebody in your home town to investigate it for you. Here you'll find the toughest civilian opposition: existing fixed-base operators who have been operating during the war and will not welcome competition. But expected aviation expansion and new airports (not to be built, for the most part, until the shooting stops) should provide at least limited opportunities for those who are willing to work hard to overcome obstacles after the war. There should also be a reasonable number of employee jobs in all these fields, although anybody who gives you an estimate as to how many is only proving that he's a bolder or more vocal guesser than you are. A great many of these jobs are not available now and won't be till the shooting's over: post-war CPT, which is on the back of the Federal budgetary stove pending at least VE day; parallel fixed-base and educational activities, and airport construction programs under Federal auspices. A great deal of this work will be decentralized. Best place to line it up is in the home town.

. . . and in the Government

As far as the Federal side of all this post-war development work is concerned, Bruce Uthus, Director of the Aviation Training Service of CAA, says "we are building only foundations for jobs now. The actual work will be getting under way about the time the boys come marching home. Priority consideration will be given to veterans in all activities —teaching in the air and on the ground, field work, inspection, and similar jobs." . . . Uthus is another G.I. Joe from the last war and represents CAA on the Department of Commerce Committee concerned with veteran reemployment and training.

To sum it up, getting lined up for a post-war job from where you're sitting right now is, in most cases, about as difficult—and unsatisfactory—as getting lined up with your post-war girl. But we thought you'd be interested in knowing that at least some people back here are thinking about post-war jobs for men now in uniform, and others are preparing to create them. Meanwhile, if you have any specific questions, drop us a line and we'll try to get you a personal answer.

CAA and the Lightplane

Behind the scenes down here during the past few months there took place what may turn out to be the most important private flying story in years. Equally pleasing to us is the fact that FLYING played a small role in the drama. The story begins with the appointment of T. P. Wright as Civil Aeronautics Administrator last summer. Changes followed which left John H. Geisse dissatisfied. Mr. Geisse, at that time a CAA consultant who had been campaigning for better lightplanes since he joined the Government more than 10 years ago, did not feel that he had enough authority to do the job he wanted to do under the new set-up. He therefore turned in his resignation. Not long after, he accepted an invitation to say exactly what he thought of the lightplane situation at a mid-West meeting. Ironically, the speech was never made; Mr. Geisse sent a few copies to friends before going to the meeting, but on arrival decided not to deliver it.

At this point, FLYING picked it up, asked him to do an article on the subject. The result was "Before I Buy a Plane," in the February issue. The pay-off came when Administrator Wright, who had been in Chicago at the International Civil Aviation Conference when Geisse submitted his resignation, came back and read the Geisse statements on plane buying and post-war lightplane designs. Instead of accepting Geisse's resignation, Wright named him Assistant to the Administrator for Personal Flying Development.

Geisse Program

Mr. Geisse promptly responded with a post-war program for personal flying development—adequate airports, s t r e a m lined regulations, revival of the Civilian Pilot Training Program, and "development of a plane for private flyers worthy of the market." That there would be no misunderstanding, he added that plane development was the most important plank in his platform. How that development will be activated in the form of research projects is as yet uncrystallized, but it can be assumed that, in line with Mr. Geisse's thinking on private planes, he will try to make them safer, with bet-

(*Continued on page* 138)

A STORY OF FIVE PILOTS

By RICHARD G. HUBLER

Thirteen Marine pilots sailed off to war last spring. Here is the story of five who won't be back.

THEIR names were Butch, Nat, Dave, Milt, and Mac. Their last names don't matter now because they are dead. They were all fighter pilots except Mac, who was pilot of an *Avenger* torpedo bomber. There were 13 of them on the transport that went to the Solomons in the South Pacific last April.

So far, three have come back. One is a hero, with 12 Japanese planes to his credit. Another scored off seven, the third got one. Maybe two or three are still out there, somewhere on an atoll with an airstrip.

The others are not listed officially as dead. Their records say they are "missing in action" because the word "dead" sticks on the military tongue as much as it does on any other. But in the opinion of their fellow pilots they will not be coming home. "The chances are a million to one," a member of their squadron said. "Sometimes they are picked up by a patrol plane or an observation scout, if they are alive. We know most of them aren't alive but some of them may have got to an island and survived or been taken prisoner by the Japs. But around Rabaul and Kahili there is a lot more water than islands and a *Corsair* doesn't stay afloat long." The man who said so was shot down into the sea twice himself.

They died, those whose deaths are known, each in his own fashion—some spectacular, some routine. Take Mac. He was a dark, curlyheaded, immensely strong fellow. He played a fair game of poker across the gray USMC blanket which was always the impromptu baize of the table-top. He liked to sing but his ear was poor and for the life of him couldn't carry a tune in a bucket. Some

(*Continued on page 92*)

Walt Disney's ANIMATED WAR

By EDWARD CHURCHILL

To produce more American airmen faster, Disney artists began a war of their own—Mickey Mouse vs. Messerschmitts.

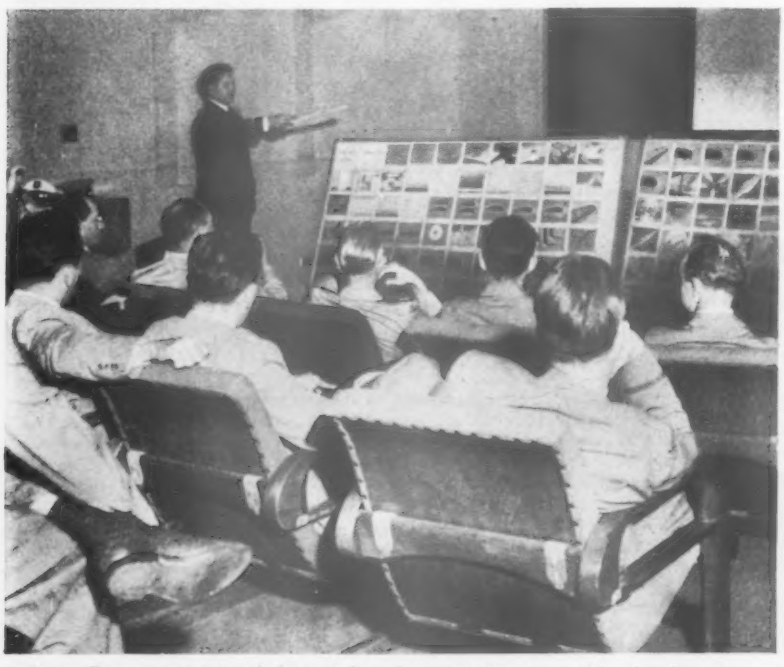
ARTISTS labored at their easels, cameramen went quietly about their photography—script writers dreamed up funny gags for a galaxy of strange characters, mostly animals—that's a prewar picture of the studio presided over by Walt Disney in Burbank, Calif. The sole object was entertainment. But today Disney and his helpers, far busier than their dwarfs of "Snow White" fame, are engaged in one of the greatest of wartime education projects. They have produced more than 400,000 feet of educational war films for every branch of the service—enough to make a continuous movie 68 hours in length. Last year the studio produced 150,500 feet, 88 per cent for Navy Bureau of Aeronautics, the Signal Corps, and the Army Air Forces.

During 1943, alone, Disney produced 204,000 feet of film. Most of it—a total of 94 per cent—was produced for the Government at cost. Yet normal production for one pre-war year was 27,000 feet. Streamlined methods of production made possible this increase.

Disney had already achieved considerable fame in all branches of the services by producing without charge hundreds of comic insignia for everything from bomber and pursuit squadrons to PT boats and coast artillery units. Any officer who wrote for "something funny to go on my squadron's planes" got just what he ordered.

But Disney actually made his first venture in producing battle films in 1939. That year he produced a series for the Canadian Government covering the operation of the Boyce anti-tank gun plus a number of war bond trailers. Then, by spring of 1942, the Disney studios were swamped by scores of orders from our own services. The Navy got there first with a request for 90,000 feet of film to be delivered in three months.

Since then Disney and his staff have dabbled in, investigated, studied and worried over virtually every Government activity, with accent on the aviation branches. They have produced films for the Co-ordinator of Inter-American Affairs, covered every conceivable subject from aerology (the practical application by pilots of the science of meteorology) and pursuit combat tactics to maintenance of aircraft by ground crews—everything from health problems in South America to electronics, electricity and superchargers. Their films have been translated into Portuguese, Spanish, Russian, Swedish, French and Italian. Chinese versions are to be undertaken soon.



Navy officer gives artists and photographers the technical background for their humorous, easy-to-understand movies that have reduced time required for air training to a minimum.

Lieut. (now Comdr.) J. C. Hutchinson in film conference with Walt Disney.

Comdr. R. F. Farwell and Lieut. (jg) Charles Wheeler check "stills" for Rules of the Nautical Road, Disney-filmed Naval "textbook."

Staff members have gone up in blimps to photograph submarines; they've haunted airports and air bases; they've ridden on aircraft carriers; they've gone aloft on simulated bombing missions, and they've flown in the fastest of planes.

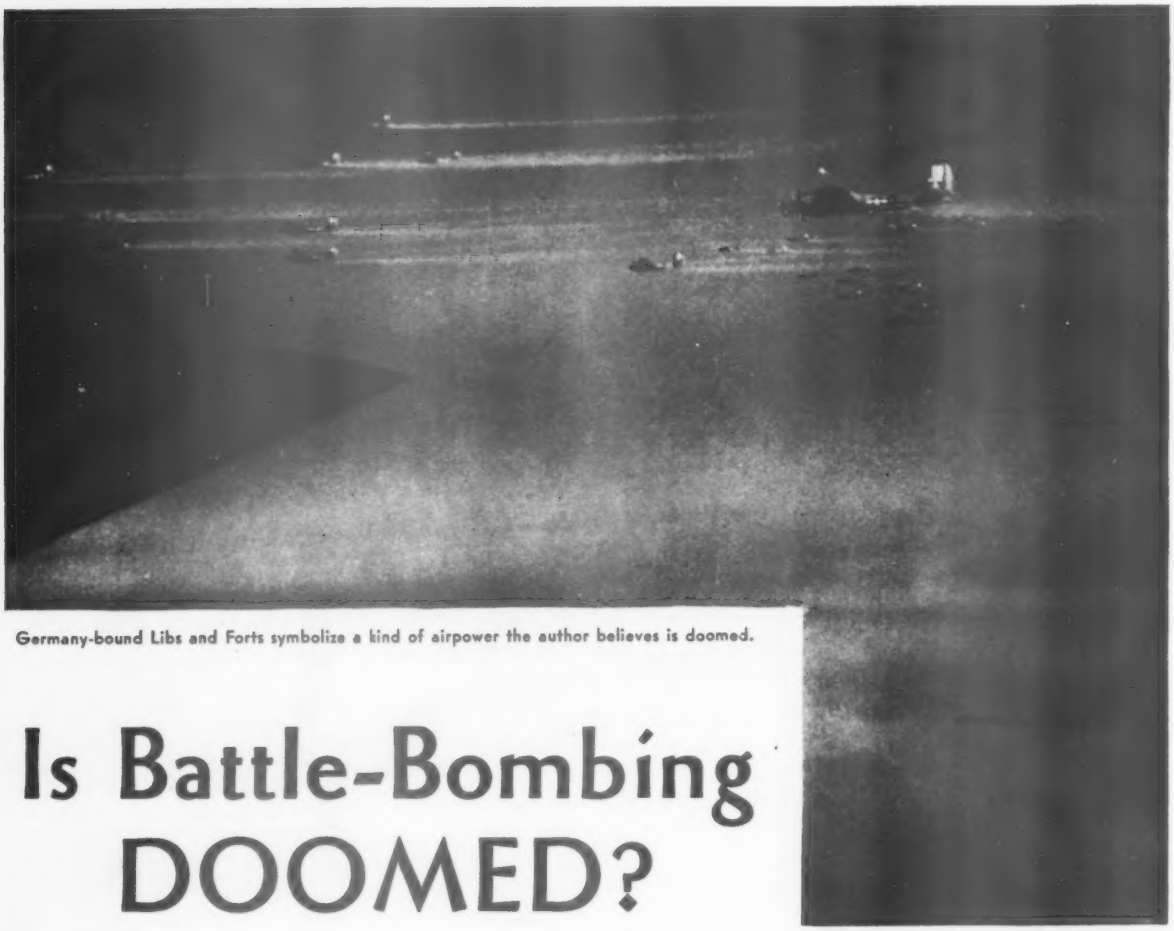
Despite the necessary influx of new untrained workers, the Disney technique has advanced from the straight animated cartoon to productions involving cartoon characters, animated graphs and charts, and live characters.

A complete series on manufacturing of aircraft, done indirectly for the Bureau of Aeronautics and with the co-operation of the leading airframe builders, was shot and released early in the war. The series has not only facilitated production but has promoted interchange of methods and ideas.

Another series, known as "Rules of the Nautical Road," will be a bible for pilots of aircraft and captains of vessels for years to come. It covers all traffic regulations to which surface vessels and overwater aircraft landing, taking off and mooring on the surface must observe. Sub-titles include "Rules in Fog", "Crossing at Night", "Mooring Lights", "Run-

(*Continued on page* 134)

Comdr. John E. Thach, creator of the "Thach weave" in fighter tactics, receives caricature from studio artists whom he advised on production of the fighter training series.



Germany-bound Libs and Forts symbolize a kind of airpower the author believes is doomed.

Is Battle-Bombing DOOMED?

By Maj. OLIVER STEWART, MC, AFC
British Authority, Editor of Aeronautics

In the future, British authority doubts heavies will fight through to their targets by daylight.

LONDON

THE merits of the two primary kinds of heavy bombing have been so clearly demonstrated during the past weeks by operations in western Europe and in the Pacific that observers of the air war in London are attempting to form conclusions.

Battle bombing, as it might be called, in which heavy bombers fight their way through to their objectives by day, has been used against both the Germans and the Japanese. Undercover bombing, by which aircraft evade the enemy defenses through the use of darkness or cloud, has also been used.

Military opinion from the first has been divided on the merits of the two methods. In the Royal Air Force there has always been a majority view among senior officers that heavy bombing by the battle method is uneconomic.

In 1936, when the Air Staff was engaged on the specifications which eventually gave rise to the *Lancaster*, the *Halifax* and the *Stirling*, there were vague hopes that the development of the power-operated gun turret would allow the heavy bomber to fight its way through fighter screens. But there was always the intention to turn to night bombing should the assault losses prove too high.

Losses did prove too high. When the *Lancaster* came into service it was first sent out on a daylight raid on Augsburg, a distance of 500 miles. This was in April, 1942, and of the 12 *Lancasters* that set out only five got back, though on this mission they were, of course, by reason of their low-flying tactics, exposed to all types of ground antiaircraft weapons.

It would appear that from that time on the Royal Air Force turned to undercover bombing for its heavy planes. When the United States Army Air Forces expressed its intention of coming to Europe to do battle bombing, some Royal Air Force officers advised against it.

They said that the whole of air war history showed that the heavy bomber must suffer uneconomic losses if it tries to fight its way through intercepter screens in full daylight.

There is the fundamental division of professional opinion. On one side there is the view that the heavy bomber cannot fight through but must keep under cover; on the other side there is the view that improved armor and armament should enable it to do so.

I think that we have reached the point where a choice may be made between these two views. I think that the war communiques reaching London during the past two months, taken with earlier experience, permit the statement that assault attacks by heavy bombers against a well-equipped enemy are militarily uneconomic. I would say that the heavy bomber, to be fully effective, must work under cover.

Although the German air force has been hit hard and repeatedly by the air forces of the United States, Russia and Britain, it is necessary today to provide

(*Continued on page* 148)

Toward a Better LIGHTPLANE

By
STANFORD J. STELLE
Former Chief, Aircraft and Flight Equipment Division, CAA

Some cowlings are excellent, others need more efficient streamlining, better fasteners.

Records of 11,000,000 hours of WTS instruction reveal strong and weak points of pre-war lightplane design.

THERE'S much to be learned about operating and maintaining present-day 50- to 75-h.p. airplanes in reports of the CAA War Training Service, formerly the CAA's Civilian Pilot Training Program. This now-discontinued program operated a fleet of several thousand of these planes —some with horsepower as high as 450— in an intensive schedule of training for civilians and for the Army and Navy, from 1939 to mid-1944. Approximately 11,000,000 hours of instruction were given.

The planes were originally operated at about 600 flight centers, but with the advent of the war the number was reduced to some 300. Fields were uniformly distributed throughout the United States at altitudes ranging from sea level to over 6,500 feet and with similar diversity of climatic conditions.

Year-round operation was a necessity in order to meet schedules of the Army and Navy; consequently, the planes were flown in all sorts of weather. Airports with paved runways and adequate hangar and shop facilities were lacking at certain centers. Such a condition is not conducive to long life of airplanes—it tends to bring out quickly any inherent weaknesses.

The entire fleet of planes was subject to rigid standards of maintenance and operation set up by the War Training Service and administered by maintenance supervisors in the field.

Reports from maintenance supervisors, compiled during regular visits to each flight training operation, were furnished to the regional and Washington office of WTS. Each plane was examined approximately every 30 days; detailed reports were made when mechanical inspection revealed chronic, unusual, or dangerous conditions. These reports contain an accurate description of each difficulty and, for the purpose of clarification, pertinent sketches or drawings.

Pointing out these difficulties should aid in designing the light airplane of the future. If the doctor can determine the patient's ailments, he can more readily prescribe a remedy. In the case of the airplane, of course, the engineer and scientist will necessarily prescribe the cure. While some suggestions may be made as to possible methods which might be employed to eliminate reported difficulties, the aim here is merely to point out the difficulties as a challenge to engineers. This survey should present a like challenge to the owner or operator in the evidence it gives that safe operation of an airplane demands that daily inspection be performed. This inspection will generally take the form as outlined on CAA War Training Service Form ACA-526. One has only to review this form to note items which generally give trouble. Engineers and scientists should make every effort to design lightplanes which do not require daily such time-consuming inspections.

Here, then, is a resume by components of the most prominent difficulties which were reported during the CAA training program.

PROPELLERS AND PROPELLER HUBS. Propellers and hubs gave comparatively little trouble. Several times, however, the thin trailing edge sections were cracked or broken out during hand cranking operations. Rings worn on the fingers of the person cranking usually caused this. Screws or rivets holding metal leading edges often become unsoldered and loosened. Blades shifted in respect to metal tipping, leaving a small portion of

Tandem seating was good on some WTS airplanes, but accident records of others showed need for stronger seats and safety belts that can't foul the controls.

the blades near the tipping exposed. Protective coatings admitted moisture which caused certain lamination separations. (Deeper penetration of protective coatings may eliminate such a condition and greatly prolong propeller life.) Propeller hub flanges were found cracked through lightening holes and some flanges had a tendency to bow out with consequent distortion between bolt locations. Splits across the face extending bolt holes were reportedly caused by wood shrinkage.

ENGINE MOUNTS. One major siege of engine-mount cracking was reported. It was attributed to a design which allowed strain to be localized at a particular point in the mount. In designing mounts of the future, full consideration should be given to vibration absorption characteristics.

COWLING. While little major difficulty was experienced with cowlings, certain minor points should be emphasized.

Anchoring methods often proved unsatisfactory in cowling removal and installation. Fasteners of the peg and pin type, in addition to poor appearance and poor streamline characteristics, have been responsible for many hand injuries on the part of airplane cleaners. Removable pins are easily lost, while other types of fasteners have disadvantages in that tools are generally required to fasten and unfasten them and alignment and fastening in some installations is difficult. Replacement of such fasteners when worn may be a comparatively difficult task.

Certain trunk-lock fasteners are difficult to operate when the peg over which the bail fits is not secured against being pulled inside and in back of the bail and lever section.

It was found that cracking of cowling at edges where flexing is encountered and at openings can be overcome only with adequate beading and support and by careful ground handling. Insecurely fastened and inadequate abrasion strips caused unnecessary cowl and structure wear as well as poor appearance and poorly fitting cowling.

FIREWALL. Little need be said of firewalls except to point out the necessity for properly-aligned holes for tubing and wiring, proper fitting and adequate grommets. Solvents used in cleaning, it was found, have a tendency to deteriorate rubber grommets. It would be well if a permanent system for protecting lines and wires could be devised—it would mean one less place to check during routine inspection.

COCKPIT. In addition to being quite full when occupied by two persons suited in winter flying togs, other difficulties with the cockpit of the average light trainer type airplanes were reported.

The seemingly simple problem of providing a resting place for the feet proved to be quite difficult. If no provision is made for heel scuff plates, floorboards rapidly wear beneath rudder pedals and, if plates are present, difficulty has been experienced with their anchorage. This has sometimes resulted in heels being jammed beneath the plates and the rudder pedals.

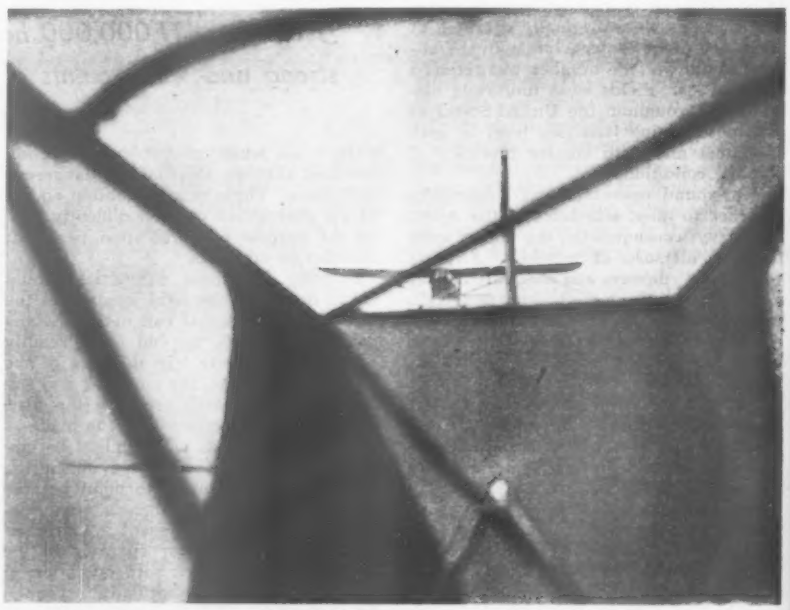
Anchorage of rugs or mats has also proved troublesome when placement of fasteners make it possible for them to be stepped on and damaged. Fraying of mats and rugs at all cut-outs has been particularly noticeable on certain lightplanes. Such a condition is not serious insofar as safety is concerned, but appearance is poor and could be remedied with new design developments.

When structural repairs in the cockpit necessitate removal of inferior fabric, great difficulty has been experienced in replacing such covering. The anchorage method presently utilized is, in the majority of cases, a one-time proposition.

Weight, cost of fabrication, and size of cockpit are most important considerations. Cockpit seats no larger than they now are could be designed to reduce pilot and passenger fatigue and to preclude possibility of seat-back breakage. They need be no heavier than the present ones. In certain tandem models seat-back breakage results from use of the back as an "assist" in entering and leaving the rear seat, thus imposing strain which the seat back was not designed to withstand.

Map and log book holders as generally provided have proved to be inadequate,

(*Continued on page* 78)



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THE AERONCA ARROW, A POSTWAR LIGHTPLANE DESIGN.

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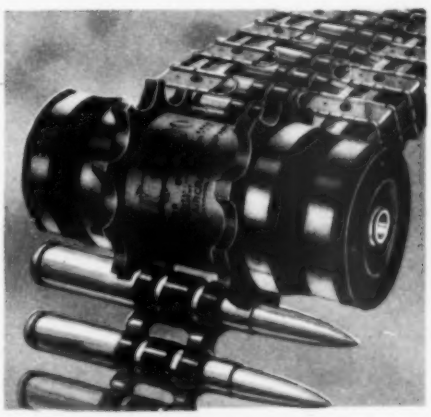

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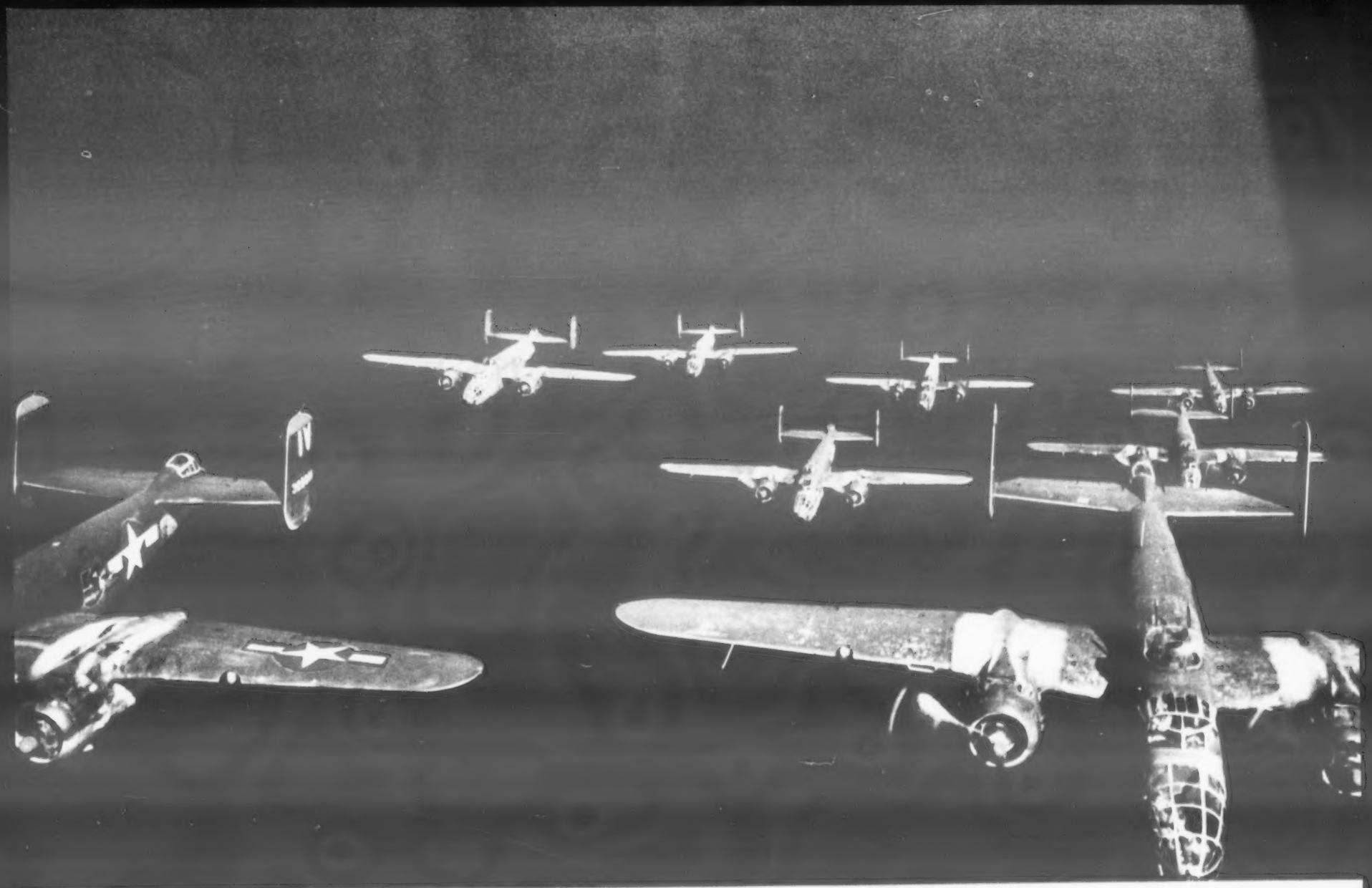

MITCHELLS OF THE 12th AIR FORCE ON A MISSION OVER ITALY.

MITCHELLS OF THE 12th AIR FORCE ON A MISSION OVER ITALY.

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IT'S a day and a world already accepted in the minds of the American people—a world of man-made flight.

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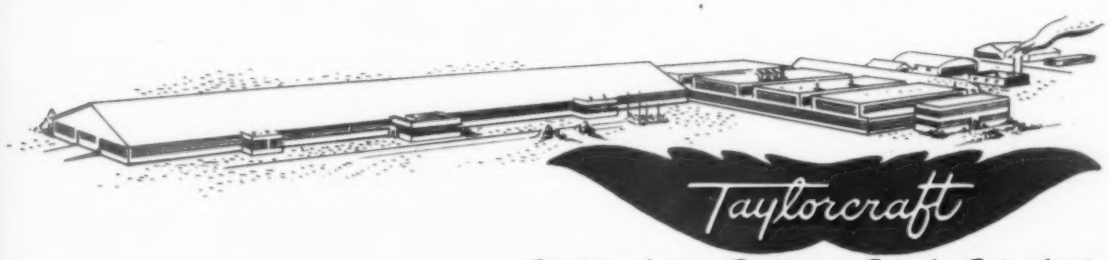

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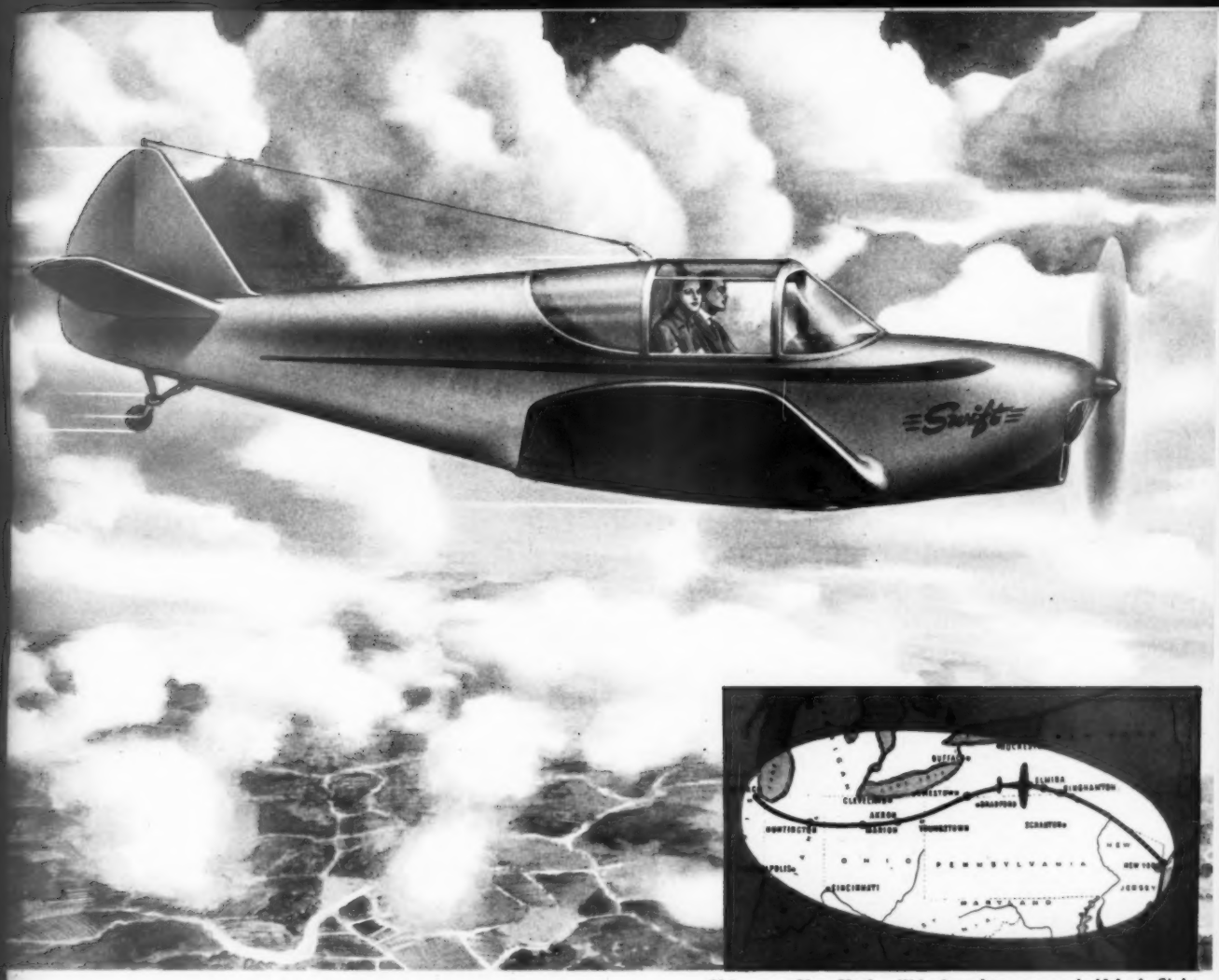

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Whether you fly your new ***Swift*** for business or pleasure, you will enjoy the satisfaction of flying a stable, easy-to-handle plane with plenty of power and speed . . . with 600 miles of cruising range . . . a plane with the utility and safety you need for *practical* personal flying.

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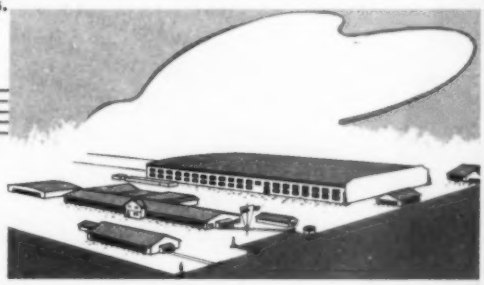

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Requests for information may be addressed to Department M.

LUSCOMBE AIRPLANE CORPORATION, TRENTON 7, NEW JERSEY

Aviation's Mike-Talk

By Lieut. ADRAS P. La BORDE

War teamwork required British and American Air Forces to get together on radiotelephone vocabulary. Here's the result of the union.

This airman's message utilizes words scientifically selected for clarity amid noise of air operations.

QUITE some time ago it became apparent that American and British Air Forces had to get together on their radiotelephone vocabulary. We were inter-communicating too much to permit the marked difference in our mike techniques to continue. Either we had to adopt British radiophone procedure or the British had to adopt ours. The result was that British procedure came in for joint use. No one knows exactly how that decision was reached. A typical Yankee explanation is that it would take the British too long to pick up our procedure.

Radiotelephony in itself is simple—almost as simple as using the house phone to call Joe's Place. But there is a variety of expressions which can be used within the bounds of intended meaning. So, in order to eliminate confusion, useless repetitions, shadowy meanings, and the like, it is necessary for all personnel using a radio circuit to employ standardized procedure terms. It is important, therefore, that every airman know the British-American military radiophone procedure. Most ground installations are now using the new radiophone vocabulary and all flyers are expected to understand and use it correctly.

First step in a radiophone contact is, of course, the initial call-up. A flyer who has a message to transmit calls the station for which the message is intended. The old American system of establishing contact was the transmission of the station's designation, the procedure word (proword) "from," and the call sign of the plane calling. The present joint procedure calls for the use of "This is" instead of "from." The rest of the initial call-up remains unchanged. If Army plane 18190 wishes to call the CAA station at Chicago, the correct call-up is: "Chicago Radio *this is* army one eight one nine zero."

The initial call-up is concluded with an invitation to the station called to reply. Ordinarily the correct prowords are "go ahead," meaning, of course, "go ahead and answer." The British proword we have adopted to replace "go ahead" is "over." The complete call, therefore, should be: "Chicago Radio *this is* Army one eight one nine zero, over." If Chicago Radio is ready to take the message from Army 18190 he terminates his reply with the proword "over," in which case it means "go ahead with your message."

End of a contact has always been indicated in American standard procedure by the words "that is all." The station using those words signified that no further answer or transmission was expected from the fellow at the other end. The correct way to indicate finished business nowadays is by using the joint proword "*out.*" Going back to the example above, after Chicago Radio has acknowledged receipt of a message from 18190 and has no further traffic with that plane, his acknowledgment ends with the word "out."

Letter	Spoken as	Letter	Spoken as
A	ABLE	N	NAN
B	BAKER	O	OBOE
C	CHARLIE	P	PETER
D	DOG	Q	QUEEN
E	EASY	R	ROGER
F	FOX	S	SUGAR
G	GEORGE	T	TARE
H	HOW	U	UNCLE
I	ITEM	V	VICTOR
J	JIG	W	WILLIAM
K	KING	X	XRAY
L	LOVE	Y	YOKE
M	MIKE	Z	ZEBRA

Alphabet code words now official for both British and American airmen.

The use of "go ahead" following a radiophone message has always been construed to mean "go ahead and acknowledge." British procedure, however, sanctions the use of the word "acknowledge" to request acknowledgment of a transmission. That is optional in joint procedure.

The prowords used to indicate receipt of a radiophone message have not changed. "Roger" is still used generally to mean "received okay," and military pilots continue to say "wilco" to indicate receipt of and intended compliance with orders or instructions.

Another expression which remains American is *"wait,"* used when requesting a calling plane or station to standby. The use of either *"wait"* or *"standby"* is sanctioned in joint procedure. It is still good business when requesting a calling station to wait to indicate the approximate length of time he should standby. British procedure suggests the use of *"wait out"* if the waiting period is to be more than a few seconds.

When an American pilot makes a mistake in a radiophone transmission he is in the habit of saying *"correction,"* then repeating the corrected version of his statement. Adoption of British procedure has not altered the practice.

If Chicago Radio had not received all of the message from Army 18190 in the foregoing example, the logical thing would be to ask for a repetition. Formerly that was done by saying "repeat," followed by a designation of the particular portion of the transmission which had not been received. The use of the word "repeat" in this connection is taboo in British-American radiophone procedure. The correct way to ask for a repetition is *"say again"* followed by the designation. For instance, if Army 18190 had reported his position as five miles south of Chicago and Chicago Radio had not understood whether the pilot had said "south" or "north," the Chicago operator would transmit as follows: "Army one eight one nine zero this is Chicago radio; *say again* all between 'five miles' and 'Chicago'; over." (An abbreviated call sign consisting of the last three digits, "190", may also be used by the plane.)

If the pilot is on the beam with his prowords, he will begin his repetition by saying *"I say again,"* meaning "I repeat."

Current instructions to military pilots and radio operators forbid the use of "repeat" in radiotelephony, except where that word is part of the text.

All military messages are classified according to their importance. The order of precedence is: urgent, operational priority, and priority. However, all flyers should know the joint prowords indicating the precedence of a radio message in order to give a particular channel the clearance called for. In standard American procedure the precedence of a message is indicated by using the word "urgent" or "operational priority" or "priority" preceding the text of the message. In joint procedure, however, an urgent message is indicated by *"emergency"*; an operational priority message by saying *"immediate;"* a priority message by saying *"important."*

The urgent proword given here should not be confused with the expression *"Pan."* The latter is used internationally by radiotelephone stations to indicate that the craft transmitting it has an urgent message to broadcast. In the aero-

(*Continued on page* 154)

ROGER !

By ROARK BRADFORD

LITTLE did the skipper realize that the rugged spearhead of the sky fleet would wing to victory that day in the plane flown by Lieutenant (j.g.) Wilco, NA, USNR. As victories go, it was not such a howling holocaust. No enemy was damaged. No problems of training or of logistics were solved. Yet, it was a major victory—a victory in semantics. For on that fateful day, the big bomber was flown 1,400 miles over the trackless sea, with the full crew talking all the time and nobody knows until this day just what. . . . But that is getting ahead of the tale.

Briefing was brief.

Lieutenant Wilco listened attentively while Acey spoke. Acey was officially nicknamed "Acey" because he was the A.C.I. officer, although everybody called him "Jack" because that was his name.

"Baker—2," said Acey, crisply.

"Roger," responded Wilco.

"Bellenger," continued Acey, handing Wilco a piece of paper. "Your sweep."

"Vectored," admitted Wilco. He walked to the strip and climbed into the big bomber. It was ready to go.

"Taxi," said the tower.

"Roger," said the pilot. Then, a moment later, "Taxiing."

"Over," said the tower.

Squared away before the strip, Wilco (his real name was Wilcox, but a French grandmother dropped the "x" because she could not pronounce it) clamped the intercom to his ears and pushed a button. "Radio!" he snapped into the mike.

"Roger," snapped AMM2c.

"Engineer?" asked the pilot.

"Roger."

"Navigator?"

"Roger."

"Co-pilot?"

"Soigned," said the co-pilot. He was a native of Bayou LaFouche, Louisiana. He could fly hell out of an airplane but he was slow at learning languages.

"Roger," said the pilot.

For six hours the big bomber bounced along in turbulent tropical fronts. Then the pilot touched the intercom button once more. "Peterman!" he called.

The plane captain came forward and touched the pilot's shoulder. "Peterman," he repeated.

"Chow," said the pilot.

"Wilco," said the plane captain.

"Mister Wilco," said the pilot, who was a stickler for military courtesy.

"Roger," said Peterman.

Chow was served in paper plates. It was chicken *a la* king, baloney sausage, fruit salad and carrots. It all came out of cans. Except for the added woody flavor from the plates, it tasted as though it had all come out of the same can.

"Pilot to navigator," said Wilco.

"Navigator to pilot," said the navigator.

"Over," said the pilot.

"Over," said the navigator. And then added desperately, "I mean 'Roger,' Sir."

"Roger over," replied the pilot.

"C'est la guerre," said the co-pilot.

"Roger," said the pilot.

Ten hours later, the pilot touched the button once more. "Roger," he commanded, briskly.

The navigator's voice came in, cold and clear. "Wilco," he said.

"Over," said the pilot.

"ETA over," said the navigator.

"PLE over," said the plane captain.

"Alnav," chirped the radio man.

"Over," said the pilot.

"ComFourFleet," said the navigator.

"Repeat repeat repeat over," shouted the pilot.

"Error error error," whined the navigator. 'Stand by for correction. Correction coming at stroke of next gong. GONG! Com4Flt."

"Roger," acknowledged the pilot.

"ComSinkSank," shrieked the radio man, now hysterical.

"Overallcognizance," the pilot sneered.

"Over Roger Wilco," moaned Peterman, sorrowfully.

"Cojones," observed the co-pilot, who could habla la español also.

Presently the pilot set the big bomber down and taxied it to a halt. The skipper came up in a jeep.

"How was the hop?" he asked.

"Wonderful," said Lieutenant Wilco. "Everybody talked all the time and nobody knew what the hell anybody was saying."

"Wonderful," said the skipper. "Wonderful. That's the spirit that it takes to win."

"Roger," said Wilco.

Spherographical Navigation

by
FREDERICK P. WARRICK
and
WILLIAM F. KLEMM
Special Engineering Service, Inc., Instrument Division

Aerial navigators can solve celestial navigation problems to an accuracy of four nautical miles with new method using a precision-ground sphere.

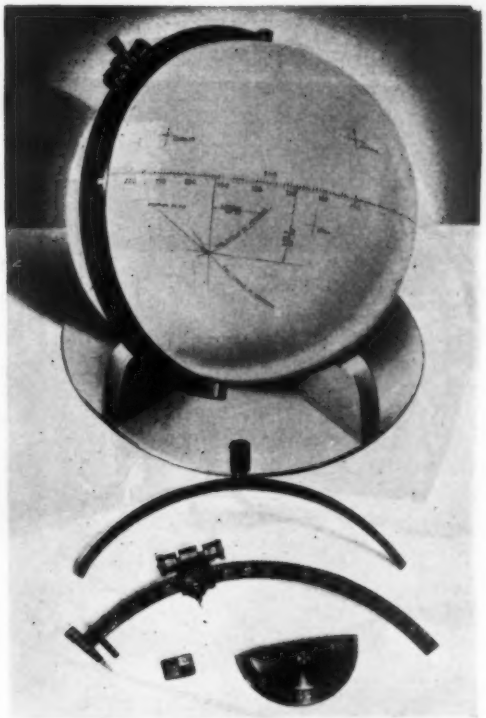

Fig. 1. Spherographical instruments are, top to bottom, sphere with meridian hoop, great circle ruler, spherical compass, spherical protractor.

CELESTIAL navigation problems may be solved to an accuracy of four nautical miles or better with the newly developed Spherographical system of navigation which utilizes a precision-ground sphere and three plotting instruments. Operation of the instrument can be so rapid that a typical two-star fix is established approximately one minute after observation. The whole unit weighs less than 15 pounds.

Besides the 14⅜-inch precision-ground *sphere* which is used for the plotting surface and has a *meridian hoop* attached to the poles, the instruments used are a *spherical compass*, a *great circle ruler* and a *spherical protractor*.

Among the many types of problems which the Spherograph can solve are (1) the determination of true course, (2) great circle distances, (3) great circle track, (4) true course segments for a great circle course, (5) drift check over a period of time, (6) course correction, and (7) advanced line of position.

Advantages over mathematical solutions claimed for spherographical navigation are:

1. Reduction of time.
2. Elimination of simple mathematical errors which would not be evident in mathematical systems until the navigator had completed his entire problem. The Spherograph actually represents celestial and terrestrial geometry correctly in three dimensions and any careless error is evident immediately, and can be easily corrected.
3. Elimination of errors in the reading of star altitude curves, or tables requiring the transformation of data into a factor before calculation, and then transformation of calculated factors into the required information. With the Spherograph, data is applied directly and required information is read directly, except for the addition and subtraction required to compensate for GHA ♈ (Greenwich Hour Angle of Aries) in some types of problems.

The Spherographical system of navigation is not expected to revolutionize navigation in general nor to make maps, charts, or other navigation instruments or systems obsolete. It is, however, a navigational system which provides a means of determining a fix rapidly and accurately once the necessary information—such as star altitude, time, etc.—are known.

The basic instrument of the Spherograph is a hollow steel sphere precision ground to a close tolerance. It is then coated with a special synthetic plastic-base enamel which has the property of producing a black line when drawn upon with the metallic pencils with which the Spherograph instruments are equipped. The plastic coating will not crack or chip due to impact or scraping. The surface is finished down to final size so that 60 nautical miles on the equator are equal to exactly .1250 inches.

Tolerance on the diameter and roundness of the sphere is held to less than the diameter of a human hair. The equator of the sphere is graduated in intervals of 1° of arc to an accuracy of plus or minus 5″ of arc. The graduations on the equator are numbered every 10° for SHA (sidereal hour angle).

Attached to the poles of the sphere is a meridian hoop which may be swung on the polar axis to any position along the equator. The meridian hoop is graduated in 1° increments from 0° at the equator to 85° north and numbered every 5° with white figures and lines for work in the northern hemisphere. A second scale for work in the southern hemisphere is divided and numbered from 0° at the equator to 85° south, but with orange figures and lines.

The outside edge of the meridian hoop (Figure 2) has notches along its periphery. These are index notches which allow the micrometer slide to be positioned at any degree interval, latitude or declination, north or south. Contained within the micrometer slide is an index pawl which may be engaged in any desired notch. The micrometer slide, once engaged in the desired degree notch, may be further adjusted to the proper minute setting by rotation of either the white or orange thimble depending upon whether one is working in the northern (white) or southern (orange) hemisphere. The thimbles have 60 divisions and are num-

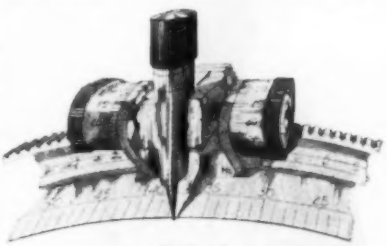

Figure 2.

(*Continued on page 107*)

Warhawk overhaul at a base in Africa where everything from burros to cargo planes was used in transporting vital parts.

GOOD OLD SPARE PARTS

By PAUL CARPENTER

As told to

FREDRIC SINCLAIR

Factory representative fought African ignorance, jungle and sand to keep Warhawks flying.

KIPLING never doctored warplanes, but of the East he wrote: ". . . where there ain't no Ten Commandments and a man can raise a thirst." But with all due respect to the bard I might add: ". . . and there ain't no spare parts!"

I've serviced warplanes for the airplane division of the Curtiss-Wright Corporation in most of the dusty corners of the Far East. I've traveled by bomber, I've ridden double in single-seater pursuits, I've squeezed in with cargo on transports, I've straddled mules, burros and camels, ridden in Army trucks, staff cars, jeeps, and in one instance wore my legs out riding a bicycle with a flat tire.

As a service representative on foreign assignment a guy works on everything that goes into an airplane. On those first *Warhawks* (then called *Tomahawks*) in the African theater I serviced machine-guns, engines, propellers and everything else that makes a fighting plane tick.

In the earlier days of the war I was sent to Africa to see that the English were correctly assembling and servicing the A, B and C series of the P-40.

My job combined extensive assembly work and instruction. I shuttled up and down Africa like Gulliver. My base was in Cairo, but I never stayed there long enough to warm the seat of my pants.

A big problem was the fact that, although American fighter planes were being received, there wasn't enough literature and instructions to go around, and there were few trained factory men.

I reached Cairo one day before the *Warhawk* shipments started to arrive. *Warhawks* were being received in considerable quantity at Takoradi by boat and had to be ferried across 3,700 miles of jungle and desert to Cairo. These planes were being serviced by some Canadian ground crew men who had worked on them briefly in England. They were doing a bang-up job, too, considering the difficulties under which they worked.

However, I was flown to Takoradi for *Warhawk* modification purposes after several serious crack-ups due to engine trouble which the Canadians didn't seem to be able to spot.

"The trouble is an oil fountain," a red-headed sergeant told me. "The pilot gets

(*Continued on page* 98)

FLYING

FOR IDENTIFICATION

1

2

3

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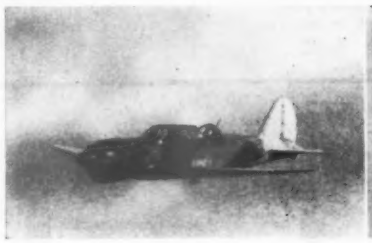

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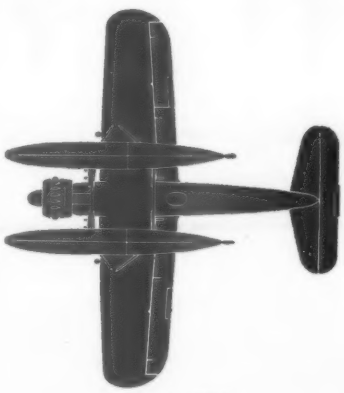
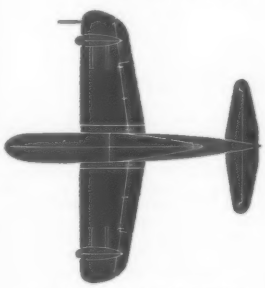
The planes are: 1. Bell *Aircobra*; 2. Beech *Traina*; 3. Lockheed Constellation; 4. *Atlas* (ap bomber); 5. Russian SU-3; 6. Dornier Do-213; 7. Boeing Clipper; 8. Blackburn Skua



Arado Ar-196A.



Vought Kingfisher (OS2U).

MISTAKEN IDENTITIES

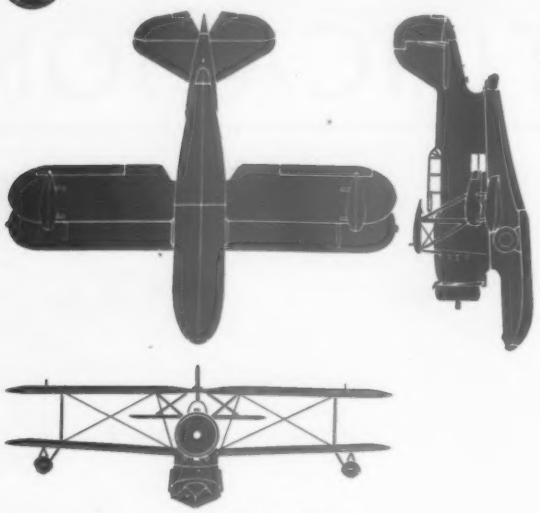
THESE are two reconnaissance planes, one enemy and one friendly, that still are seen in certain war theaters. The German Arado Ar-196A and American Vought *Kingfisher* look strikingly alike. While both are equipped as landplanes at times, they are most often seen on floats. The twin floats of the German plane are quickly distinguished from the single American float. Otherwise, both follow the same general lines and might be mistaken for each other at a quick glance. All three views are shown here to exact scale.

Ar-196A span: 49 ft. 2½ in.

Ar-196A length: 38 ft. 2½ in.

Kingfisher span: 36 feet.

Kingfisher length: 33 ft. 10 in.



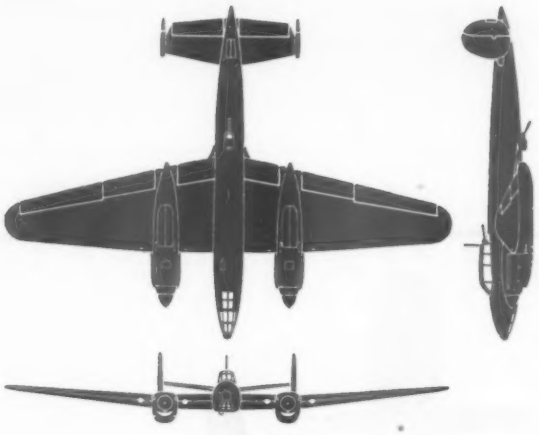
FLYING, March, 1945

GRUMMAN DUCK

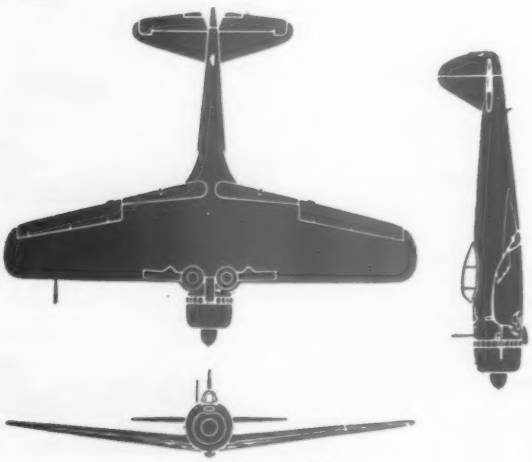
ORIGINALLY designed and produced by Grumman, the *Duck* now is in production by the Columbia Aircraft Corporation, Valley Stream, Long Island, New York, under the Navy designation J2F-6. It is a J2F-6 that is shown in the photograph above. The last *Duck* model produced by Grumman was the J2F-5. The current version of this utility amphibian is powered with a 900-h.p. Wright engine. Top speed is 190 m.p.h., cruising, 155 m.p.h., stalling, 70 m.p.h. Service ceiling is 20,000 feet. It carries a crew of three for a range of 850 miles. Wing span is 39 feet, length, 34 feet; height (on wheels), 13 ft. 11 in. Gross weight, 7,700 pounds.

PETLYAKOV PE-2

THIS is a widely-used dive bomber and reconnaissance plane in the Red air force. A three- or four-place low-wing monoplane, the PE-2 is powered with two liquid-cooled 1,100-h.p. M-103 engines. Performance includes a top speed of 335 m.p.h. at 16,400 feet, cruising speed of 266 m.p.h., landing speed of 87 m.p.h. Service ceiling is reported to be 29,500 feet, normal range, 930 miles. Maximum gross weight is 18,730 pounds, maximum wing loading, 43 lbs. per sq. ft. Bomb load is 2,200 pounds. Wing span is 56 ft. 5 in., length, 41 ft. 8 in. Wing area is 592 sq. ft.



FLYING, March, 1945



FLYING, March, 1945

NAKAJIMA OSCAR

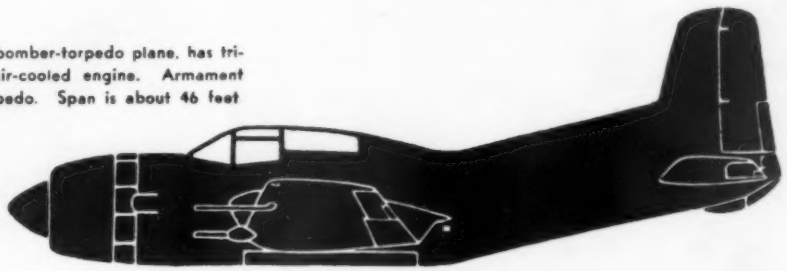
ONE of the Japs' older fighters, the *Oscar* is an army design and still is seen by U. S. combat flyers. A low-wing, all-metal monoplane, it is powered with a 1,000-h.p. air-cooled engine. Top speed is reported to be 320 m.p.h., maximum range, 1,500 miles; service ceiling, 35,000 feet. Wing span is 37 ft. 8 in., length, 29 ft. 2 in.; gross weight, 4,785 pounds. Its best performance is reported to be at 18,000 feet. Wing area is 233 sq. ft. Armament consists of two 12.7-mm. machine guns (approximately .50-cal.) mounted on the engine cowl. Oscars are land-based only; the more widely-known Jap fighters (*Zekes*, etc.) are operated by the Jap navy.

HAVE YOU SEEN?

Described by enemy sources as a "magnetic aircraft detector," this appears to be an older type of German radar-like device.

Unusual picture of a one-ton bomb dropping from an Avenger on a Jap target was taken by a FLYING photographer in the Pacific.

Douglas BTD-1, experimental U. S. Navy bomber-torpedo plane, has tricycle gear, inverted gull wing, single air-cooled engine. Armament includes two 20-mm. cannon, 21-inch torpedo. Span is about 46 feet



New Consolidated Privateer is a revised single-tail Navy Liberator. Officially the PB4Y-2 (dubbed Two-by-Four by its pilots), it has two top turrets and a new waist turret like that on PBY's.

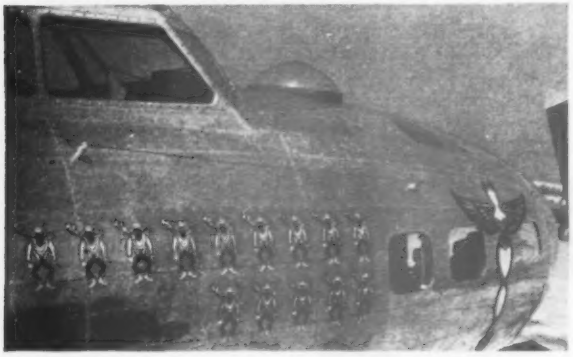
HAVE YOU SEEN?

(CONTINUED)

Beer-filled wing tanks recently were flown to RAF men in France by several Spitfires.

Experimental "butterfly" tail recently was tested on a Beech Wichita (AT-10). Purpose was to investigate simplified structure and controls, and test compressibility effects at high speed.

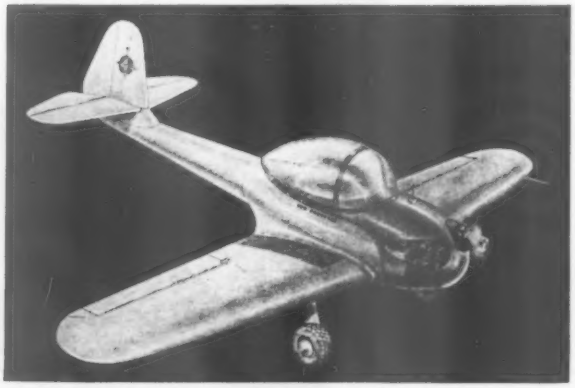
A post-war Piper design is the four-place Skysedan. Powered with 165-h.p. Franklin, top speed is 140; cruising, 125; landing, 50. Range is 500 miles, span 34 ft. 7 in., gross weight, 2,300 pounds.



AAF Aero Medical test Fortress has gremlin on fuselage for each flight over 40,000 feet. Highest flight to date was to 43,600.

Army ATSC pilot tests Curtiss Warhawk on skis at Ladd Field, Alaska. Ski gear retracts fully. Plane flew from 11-inch-deep snow.

Photo of Marine Hellcat fighters in Pacific is from Navy magazine, shows unusual installation on planes' starboard wings.

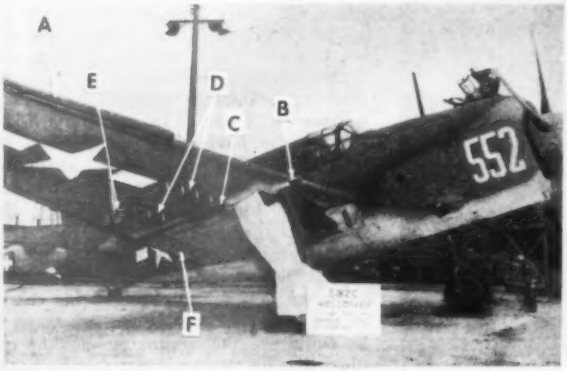


Piper single-place design is the Skycycle, with 40-h.p. Continental. Top speed, 115; range 350 miles; span, 20 feet; weight, 630 lbs.

Navy air-sea rescue boat fits on wing of Catalina, is dropped onto water. Weight: 1,500 pounds.

Another recently-announced version of Mosquito is this pressurized Mark XVI. It operates at 30,000 feet, has dropped two-ton bombs on Berlin. Is fitted with cameras (note windows).

First report of Mustang carrying two persons in cockpit came from Europe after General Eisenhower toured in P-51B (nose at right). Picture at left shows two-place version of P-51D. Note that it has Navy-type hard rubber tail wheel.



This is latest Helldiver, SB2C-4. Note slot (A), cannon (B), bomb rack (C), rocket launchers (D), radar antenna (E), holed flap (F).

A recent experimental military autogiro was this G&A (now Firestone) XO-61. It was a pusher and was designed for direct or "jump" take-off.

I Learned About Flying From That!—No. 65

By FRANK J. FARONE

An instructor tells how to get the most out of the "I Learned About Flying" features and, incidentally, presents the case for student-maligned instructors.

JUST recently I learned that there's more to one of these "I Learned About Flying From That!" features than meets the casual eye. It was James Gittings' "little lesson" [No. 61, in the November issue] that brought about the discovery. And it's not just that I'm an instructor and that Mr. Gittings has a pronounced "blame-it-on-the-instructor" bias. It's just that his article reveals—to the eye of an instructor—a great many things he has yet to learn about flying.

For one thing the author failed to recognize that lack of planning was the basic cause of washing out his airplane—at least he never mentioned it in his article. He stated that he "had been practicing plotting a careful course on the trip up north past Seattle to Everett." But he did not "bother to figure a reciprocal course for the return flight." One wonders why he even bothered to take the maps with him on the return flight. Specifically, he failed to plan even the bare necessities for a successful navigation flight. He did not prepare his maps, he failed to select brackets that would hold him reasonably near his course, and he failed to plan a course of action to be followed in the event he became lost. His first error, then, was one which doesn't appear until you read between the lines—it was simply lack of planning.

His second error was faulty navigation—he "took the wrong valley." A simple check on compass heading might have made the return trip uneventful. One gets a picture of complete confusion upon learning that he could see "for 40 miles," yet couldn't see the Pacific Ocean which was only seven miles away. Yes, confusion is the only explanation for an emergency landing in the first likely field available—with 1½ hours of gas supply remaining! A pilot can afford to be more discriminating in selecting a field for forced landing if he has more than 100 miles left in his tanks. Air judgment is something a pilot should develop, or else he learns the hard way as this unfortunate pilot did.

Author Frank Farone has logged more than 2,800 hours in everything from lightplanes to Flying Fortresses. At present, he is commanding officer of a training squadron.

The third error can be traced back to the time that Mr. Gittings purchased his plane, because it's evident he never bothered to learn the limitations of his equipment. I have flown the Kinner Bird and one of the first things I learned is that it will not take off in 600 feet with a full load. To me, it seems incomprehensible that a person would pay $1,000 for an airplane without learning its performance characteristics under all conditions.

The question, "Why didn't somebody tell us it couldn't be done?" is not a valid excuse. Would one expect his instructor to say, "Now you can take off from this field with a Piper J5, Aeronca, Taylorcraft, Waco UPF-7, Stinson, Beechcraft, or Culver; but don't try it with a Lockheed *Electra*, Eaglerock, Travel Air, or Piper J2." Such instruction would only add to the student's confusion. An instructor could spend hundreds of hours explaining when to take off and when not to take off—stuff that involves considering the type of field, field elevation, hills, wind, ground temperature, obstructions, type of equipment, and the loading of the equipment. All this boils down to that quantity known as "air judgment." A person can be *taught* how to fly, but there isn't much an instructor can do about the way a student exercises his air judgment.

"Why didn't our instructors tell us when not to take off? Why didn't the CPTP course provide such instruction?" The answer is that an instructor would have to be an aeronautical engineer, accomplished meteorologist, and prophet to answer such questions. The primary course of the CPTP had as its aims (1) to teach students the fundamentals of flight; and (2) to inculcate good flying habits in the students. These are also the objectives of every good instructor. No one could expect to become an expert pilot [as this pilot assumed] at the completion of the primary CPTP course. With the time allotted and the equipment available in that course, it would have been impossible to cover thoroughly the one subject, "When not to take off!"

I have had several experiences with students who have tried to blame everyone but themselves for their shortcomings—students who failed to use air judgment. Here are a few examples:

One student asked me to check him out on cross-country so that he could get the cross-country time required for a private pilot certificate. He owned his equipment, a Piper J4. I started to give him a briefing for the navigation problem but he wasn't interested (he knew all about it). We took off from Cincinnati and went to Richmond, Ind., then on to Dayton. On that portion of the flight from Dayton to Cincinnati he became over-confident. We were still 20 miles from our destination when he nonchalantly placed his charts in the baggage compartment. I asked if he could see the destination and he replied that he could not but that he knew his position We were right over our des-

(*Continued on page* 154)

WANTED: Man to Run Small Airport!

No experience necessary! You can make money, be your own boss, and run your own business—*your own airport!* This is the money-making end of aviation, the new postwar industry. Right now you may be a mechanic or a salesman, a small business man or an ex-service man. You don't need a big cash outlay or a fancy set-up. All you need is "know how"—and that's where Aeronca comes in.

Right where you live! Aeronca's been a leader in the personal plane field for more than 16 years, knows how it's done. This company has a complete, profit-making program that tells how to go about making money with a small airport in your own home town. The plan covers more than just selling planes, goes into every last detail—even the money you can make selling gasoline and oil—and that's only a minor part of the business.

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Letters

ONE FORTRESS, NOT ACCEPTED

Sirs:

In William W. Prescott's article, "Accepted One *Fortress*" (December issue of FLYING), the author says the vacuum pumps are on engines No. 3 and 4—they really are on No. 2 and 3 engines. And fuel pressure, instead of 15.5 pounds should be nearer 17 pounds for diaphragm-type carburetors of the size used on the *Fortress*. At least that pressure is in keeping with Army technical orders.

CAPT. JACK G. MCCAULEY, AC

Dallas, Tex.

WHODUNNIT?

Sirs:

The "Atmosphere Chart" presented on page 28 of your February issue was excellent. Could you tell me who is responsible for getting it up?

JACK ROBERTS

Tulsa, Okla.

● Credit for the chart should have been given when it was used. It was arranged by AiResearch Manufacturing Company, Los Angeles, Calif.—ED.

IDENTIFYING THE JAP

Sirs:

In your January issue (page 79) you show silhouettes and a photo of the Jap Mitsubishi 97-3 which you call *Sally* III. Under the new system of coding for Jap aircraft this plane is known as the *Sally* 3. The single digit indicates that it is an Army type, and the numerical value of the digit indicates it to be the third modification of the basic *Sally* type.

Also, on page 81, is a photo of a Jap DC-3 identified as *Tess*. That plane is now known as *Tabby* 11 or *Tabby* 22. Again, the two digits indicate a Navy type and the numerical value of a single digit indicates, in this case, either first or second models.

HUGH YOUNG

Winnipeg, Man., Canada.

MORE RE WASP'S

Sirs:

Tell Barbara Poole for me that pilots in Army contract schools were actually under contract—it wasn't possible for them to leave for other branches of the service when the war came along. It wasn't even possible to leave after one's contract expired unless the AAF Training Command okeyed it, which didn't happen very often.

Now that the job for which those men were needed is about over, I suppose it would be wrong to put them in the ATC and put a girl out of a job. Sure toss 'em in the infantry—after all, they can't knit.

F. PETELLA

Chicago, Ill.

Sirs:

My heart bleeds for the poor young WASP's. It's terrible to think of all these women being deprived of their livelihood. Of course the men who were flying before these gals were out of short skirts don't really matter . . .

LIEUT. JOSEPH LUCKEY, AAF

Columbus, Ohio

Sirs:

In all fairness, let's give the girls credit—they took a job and did it well. Just as Miss Poole says, the possessors of these "snake wings" (service pilots) were too busy in the early days of the war collecting the big wages paid primary instructors to bother about any of the flying services. Now that the training program is being curtailed they are crying to high heaven to get into ATC.

A FIGHTER PILOT

Overseas

Sirs:

An article entitled "Requiem for the Instructor" would be more to the point—and while we're bidding him farewell let's not call him a draft-dodger.

Personally, I had to use part of my college allowance to get started in flying. It took me two years to get my first 87 hours. That was almost 10 years ago. When the war came along, I owned a plane. But I sold it and took a 50 per cent cut in salary because the Army needed instructors.

THOMAS E. GIVENS

Sweetwater, Tex.

Sirs:

I am one of the WTS boys who went through courses without pay or fancy uniforms just because it happened to be flying—the thing most of us had dreamed about since we were kids; one of the guys who eventually filled gas tanks and wiped windshields for the WASP's, after ending up in an aviation mechanics school when the Government had no flying berths for the men; a guy who is happy to say that when he goes overseas it will not be with the air forces.

JOHN T. STOFEY

Wilkes-Barre, Pa.

Sirs:

The WASP requiem was a sad story, but let any WTS man tell you his tale of woe if you want real tragedy. . . . And since the girls want air equality, I suggest we test their sincerity by opening up the cadet training program to them—then let them fly combat a while.

A/C CHARLES E. KOON

Seymour, Ind.

INFORMATION PLEASE

Sirs:

As Miss Poole so aptly stated: "Planes know no sex"—yet it is very evident that women must continue to fight every inch of the way for recognition in the field. We have heard about large companies—Grumman, for instance—that are quietly experimenting with women pilots. Yet there seems to be no connected method of obtaining information of this sort. If you could offer any suggestions, we would sincerely appreciate it.

WINFREY M. ROBINSON

Biggs Field, Tex.

● So far as we know, Grumman is the only large company that has made such experiments. We suggest that interested readers write Jacqueline Cochran, % WASP, Pentagon Building, Washington, D. C.—ED.

STATE VS. FEDERAL

Sirs:

In your article "Must We Have 48 Air Dictators?" [FLYING for January] you say that the state of Colorado is now permitting two airlines to operate, and lines

(*Continued on page* 152)

FLYING

". . . and now meet our catapult officer!"

THINK of it! One-fourth shorter takeoff runs! One-third higher rate of climb! Cruising faster and farther at the most favorable altitude! All with minimum fuel consumption and engine wear. That's what Aeromatic—*the one and only self-acting variable pitch propeller*—means for that postwar plane of yours. And it means long glides for happy landings—with an instantaneous change of pitch for a quick pickup if you overshoot the field.

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THE LIBRARY

FIGHTING WINGS, by Gilbert Paust and Martin Lancelot; published by Duell, Sloan and Pearce, Inc., 270 Madison Ave., New York, in 1944. 256 pp. Price $2.75.

Fighting Wings sets out to tell the story of combat aviation from the first reconnaissance flight of an RAF plane over Mons in 1914 to the aerial phase of the Allied invasion of western Europe. It is half text and half pictures, using as sources the National Archives, British, Australian and Canadian Information Services, news and magazine picture services and those of the United States Army and Navy. The authors concentrate on showing the development of military and naval aviation, Allied and enemy, in the stress of combat, plus the use of various types of aircraft in different combat theaters.

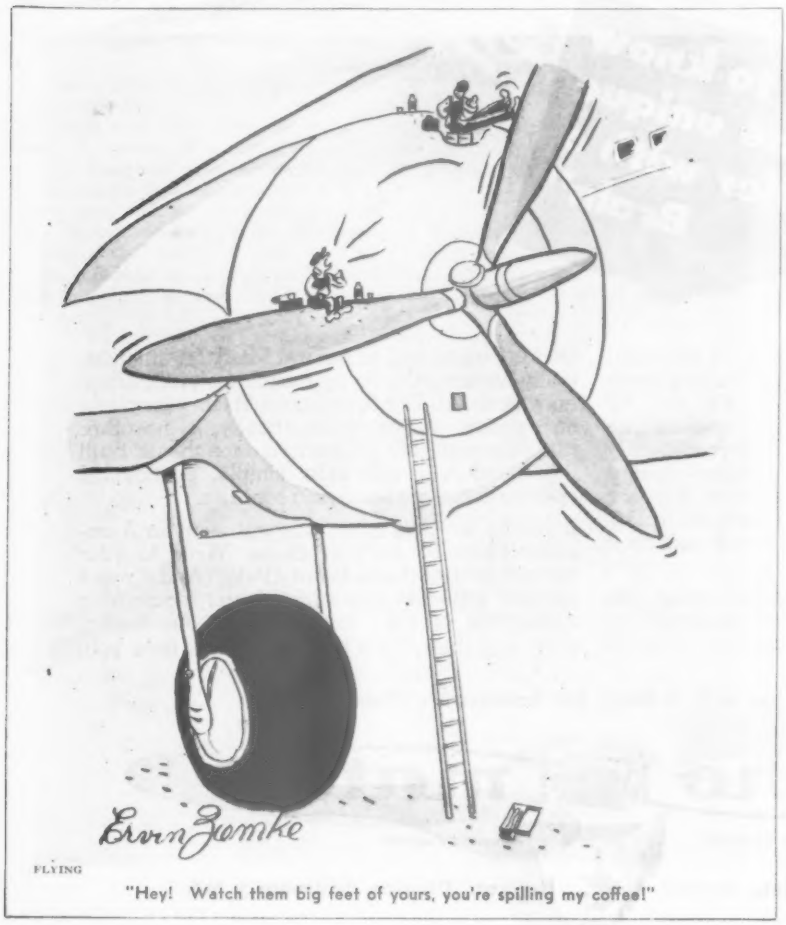
Many of its photographs are excellent. Some few are new and exciting shots of aerial combat but perhaps too many are "stock" stuff, already familiar to newspaper and magazine readers. Many, perhaps necessarily, are plain identification pictures of aircraft types in flight. And this "history" of the development of the war plane in World Wars I and II does little more than indicate how today's fighters, bombers, patrol planes and transport ships were evolved through the workhorse routine of peacetime flying.

But the text does give a compact picture of how the warplane and its tactical and strategic uses are developed in the rigors of combat—how, for instance, the science of bombing grew from a pilot leaning overboard to drop an artillery shell with fins on a supply dump to vast air fleets swarming over a great enemy center and saturating it with thousands of tons of explosives.

Among the most interesting photographs are shots of a *Beaufighter* firing rockets at a Nazi ship off Norway; a German ack-ack burst filmed at night by an RAF camera; the strafing of a German train, with its cars exploding one by one; a Mitsubishi bomber gliding through a pattern of flak just before it was downed. New and interesting, too, is the revelation that Allied aircraft in World War I used rockets fired from the wings in attacking Zeppelin raiders. Reproductions of actual combat reports made by famed pilots in the two wars are presented.

There's a hint of the future of aerial warfare, too, in glimpses of jet propulsion planes and robot bombs. Altogether the book is easy-to-read, though not too instructive for the layman.

RICHARD O'CONNOR,
Los Angeles *Herald-Express*



FLYING

"Hey! Watch them big feet of yours, you're spilling my coffee!"

CLOUDS, WEATHER AND FLIGHT, by Thomas Gillmer and H. Erich Nietsch; published by D. Van Nostrand Co., 250 Fourth Ave., New York, in 1944. 161 pages. Price $3.75.

Here is a book that combines three subjects: weather, forecasting, and soaring. The large slick-paper pages contain, in addition to a profusion of sketches and photographs, 10 charcoal drawings of cloud types that are themselves worth the price of the book.

While there is some doubt as to the meteorological value of the drawings, the two authors have presented their material clearly enough for either pilot or nonflyer. And while they have not emphasized the dangers of such weather hazards as thunderheads sufficiently, they have, in the three different parts of the book, covered other subjects efficiently and well.

For example, Part I covers weather, from clouds to air masses and fronts. It must be admitted, however, that it is the clear, concise, down-to-the-reader type of writing that makes the book—photographs and sketches, profuse though they may be, will never tell a novice what a cumulo-nimbus looks or feels like.

Part II takes up "Flight and the Weather," with an analysis of weather maps, forecasting, and weather hazards. Although there is some doubt in one's mind as to how accurately the usual pilot may be able to forecast weather (in view of the 20 per cent acknowledged failure by experienced meteorologists), Part II will certainly help anyone who reads it.

The last section, "Flight," takes up the question of soaring. This chapter should be read by all pilots, because, believe it or not, even a powered lightplane can soar and fly cross-country better if its pilot knows thermals.

The book is short, to the point, interesting, and written in simple language.

JOHN R. HOYT,
Author of *Safety After Solo*

SHORT VIEWS

PRODUCTION ENGINEERING IN THE AIRCRAFT INDUSTRY, by William H. Schutt; published by McGraw-Hill Book Company, 330 West 42nd Street, New York, in 1944. 307 pages. Price $3.

A text that attempts to explain the estimation of contract costs, the budgeting and scheduling of direct labor hours, work simplification, etc., for the student who has no previous production knowledge.

HELLDIVER SQUADRON, by Robert Olds; published by Dodd, Mead & Company, 432 Fourth Ave., New York, in 1944. 225 pages. Price $3.

A fictionalized account of Carrier Bombing Squadron 17 (with Task Force 58) from Tarawa to the Marianas. END

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Toward a Better Lightplane

(Continued from page 54)

unable to long withstand usage. Little thought has been given to a proper display of license and registration papers. In most cases fire extinguisher location and anchorage problems have been partially overcome; a few reports indicate that, in rough air, extinguishers have loosened and have either struck the pilot or have temporarily jammed controls. The fire extinguisher must be secure but readily removable—anchored in a position easily accessible to both pilot and passenger or student. First aid kits should be mounted in plain view and in an adequate holder. They should be located in a position least susceptible to being covered by structure in the event of "crack up."

Many problems have been reported regarding engine controls within the cockpit.

The average lightplane contains no provision for throttle quadrant friction plates—creeping throttles are the result. Control markings proved to be generally unsatisfactory. Students would be greatly aided if markings remained legible and bright during the entire life of the plane. Marks placed on upholstery or fabric in close proximity to controls are eliminated by patching or refinishing of such material. Often they are not reinstalled.

In designing any airplane to be used as a trainer, thought should be given to accessibility of controls to both pilot and student. Serious difficulty was reported on one model in which only the occupant of the front seat was able to reach the carburetor heat control. This plane was placarded "solo flight from rear seat only" and under such conditions carburetor heat could not be applied by solo students.

Difficulty was likewise reported with "do not exceed" markings painted on the glass faces of certain instruments in the cockpit. Faces have revolved and have accordingly changed position of these markings.

Stabilizer or tab indicating devices on the average lightplane are likely to give false readings. They are generally of such flimsy design as to be comparatively short-lived. The actuating mechanism of the control itself was in many cases a source of difficulty.

It was found impossible for pilot and passenger to stay warm without the use of heavy flying suits which are not conducive to comfort or quick action. Some type of satisfactory independent heating system with outlets at both seats should therefore be devised for the light airplanes.

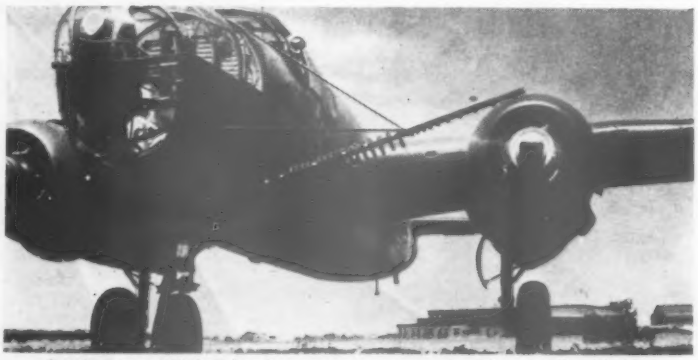
Difficulties with windshields, skylights and enclosures were repeatedly cited. Most common seemed to be the short life of the transparent material, due to the effect of hot sunlight and to rapid change of temperature. Sunlight rapidly discolors, checks and makes brittle certain materials now commonly in use. In numerous cases such materials cracked when a plane was moved from a heated hangar directly out into severely cold atmosphere. Provision must be made for expansion and contraction of the various materials now in use.

Simple, quick methods for removal and reinstallation of windshields should be developed which eliminate the necessity of drilling out old rivets and installing new ones. Likewise, thought should be given to providing a windshield with curves and contours designed so that objects seen through it will not appear distorted.

Prominent among difficulties with enclosures are those connected with scratching when pieces of transparent material must slide by each other or into a recess. The majority of slide channels are difficult to operate and the spacing of these channels is such that rubbing of material and consequent scratching is prevalent. There were several reports of side enclosure material being blown out because of the flimsy nature of its anchorage.

The CAA War Training Service favored maximum visibility, and in no instances was permission granted to remove skylights built into the airplane by the manufacturers. But skylights were difficult to maintain in satisfactory condition. Anchorage is inadequate and short-lived, as

PROP DE-ICING



Outrigger on Mitchell bomber sprays water on portside propeller blades.

Applying "Ice-lac" to propeller blade.

Bands indicate effect of anti-icing solutions at 20,000 feet altitude.

PROPELLER icing remains one of the great unsolved aviation problems.

Curtiss-Wright representatives, working with Materiel Command engineers, are using a *Mitchell* equipped with 44 electrically-heated atomizer nozzles which direct a spray upon the propeller under icing conditions. Crew members study the formation and action of the ice on the propellers and take photographs showing how ice forms and the effect of de-icing preparations.

Hamilton Standard has developed a chemical method of anti-icing. A black, viscous substance called "Ice-lac" is painted or sprayed on the propeller blades and provides protection below 0°.

A common method of de-icing is the slinger-ring system used by some airlines to feed a de-icing solution onto the propeller blades. Disadvantage is that the system weighs 10 pounds for each propeller and requires another 10 pounds of fluid for each hour of operation.

Other de-icing methods involve application of heat. In one case, a hollow steel propeller blade, with small openings to admit hot air drawn from the engine, is being tried out. Electrically-heated propellers have attained considerable success in tests and have the advantage that controlled heat is applied to the leading edge of the blades.

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is the transparent material generally utilized.

Flight characteristics are slightly changed when the edges of the skylight are not securely fastened and are drastically changed when skylights blow out. Consequently, operators must maintain these items in good conditions at all times. But improvement of the skylight should not reduce visibility.

Safety belts generally accumulate dirt and grease and transmit such items to the clothing of passengers. Their placement is generally such that, if left untied at an unoccupied seat, they may foul controls. Designers should provide means whereby belts would not hang loose if the pilot neglects to tie them across unoccupied seats.

FUSELAGE. The average fuselage proved capable of withstanding normal stresses, but abnormal landings many times inflicted damage, particularly near landing gears. It is generally known that "beefing up" members at this location is usually not the answer to this problem, manufacturers should make provision for access to this particularly vulnerable spot so that repairs may be adequately and easily made without affecting the plane's appearance.

Thought should likewise be given to designing fuselages in such a manner that re-cover work done outside of the factory does not result in bent and bowed longerons between braces.

It is generally quite difficult to inspect and work on the extreme tail end of the average lightplane fuselage. This fact, coupled with generally inadequate drain provision, is frequently responsible for rusty tubes and for the entire section becoming dirty.

Planes would last much longer if provision could be made for eliminating the possibility of water standing along longerons.

Provision of a tail tie-down ring on the fuselage would prove extremely valuable as would tail lifting lugs or handles. Secure anchorage and elimination of much fabric damage would result.

Fabric has been damaged in many instances wherein metal fairing edges have vibrated and have cut into adjacent material. Simply and securely installed antiabrasion material would overcome this situation.

WINGS. Wing leading edges on certain models received their share of comment from maintenance supervisors, although only isolated reports of leading-edge collapse were received. Design is probably not wholly at fault in such cases. However, more thought might be devoted to protective covering which does not rely solely on glue and nails.

Several reports have described a condition wherein flexing of wings has caused the sharp sides of metal leading edges to bow and cut wing fabric.

Designers should make provision for "bumping out" metal leading edges in the event they become dented. The unsatisfactory practice of drilling and inserting a metal screw in order to pull out a dent must be resorted to at present.

Inadequate and, in some cases, poorly placed drain holes have resulted in internal wing damage from standing water. A type which is not easily plugged by dirt should be devised.

The majority of spar difficulties have resulted from operations in arid regions. Longitudinal cracks in the vicinity of plywood reinforcing plates have been reported in many cases. These were caused by drying of the spar, resultant shrinkage being resisted by the plywood plates, which do not shrink in exactly the same proportion.

Cracks usually start at a bolt hole and spread until they extend beyond the plate to a point where shrinkage resistance of the plates is not present. Such a cracking condition is more prevalent in spars carrying comparatively thick plates opposite each other. Little tendency to crack has been noted when plates are installed on only one side of the spar. Thought should be given to impregnating wooden spars with a protective material which would retain the correct moisture content within the spar for long periods of time. And some day a wing must be designed which does not require a "major operation" when a spar is cracked or broken.

CONTROL SYSTEM. Abrasion has proved the greatest enemy of the control system. Heavy strain is often put on the section of cable which links the front and back pedals of the tandem type airplanes by instructors "taking away" controls from students. Stabilizer or tab adjustment mechanisms are subject to rapid wear and bending on certain models of airplanes. Design should provide for long periods of trouble-free operation of these items. A hydraulic system of control might solve the problem. Very few working parts need be between the control column and the control surfaces.

CONTROL SURFACES. With the exception of reported rapid wear of hinges and hinge pins, little difficulty has been experienced with the control surfaces themselves.

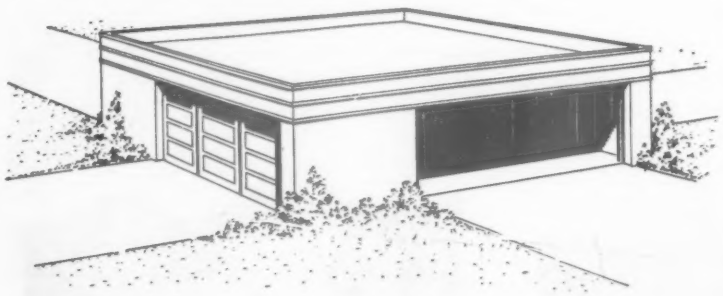
FABRIC. While little or no major difficulty was experienced with fabric, certain minor changes seem necessary.

Some thought should be given to installation of "dams" at strategic spots on the fuselage. By lifting a skylight or a side window, large sections of fabric have in some cases been blown away. Tape across certain sections of the fuselage might prevent this. Such procedure might prove especially valuable along the bottom of the fuselage where oil and grease, and perhaps a bit of battery acid make fabrics comparatively weak.

Some criticism has been directed against certain color schemes currently in use. Combat planes must be as invisible as possible. On the other hand, training and commercial planes should be painted in such a manner that they may easily be seen, no matter over which color terrain they may be flying. An airplane painted like a peppermint stick may not be the

(Continued on page 84)

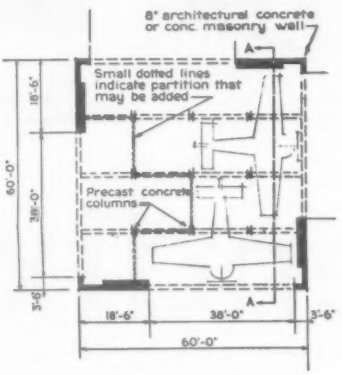
LIGHTPLANE HANGAR



CONCRETE hangars housing from four to six lightplanes have been suggested in designs offered by research architects of the Portland Cement Association.

Of square design they would consist of eight-inch concrete or concrete block walls, precast concrete columns supporting a concrete slab roof, and have concrete flooring and footing.

Doors open on all four sides each providing a 38-foot opening, ample for most lightplanes. A wider or narrower door could be made if desired. The arrangement allows each private plane an unhampered entrance and exit to its allotted stall. Estimated costs approximate $200 to $250 per plane.



PRODUCING WING SPARS ON SHORT ORDER

By WILLIAM WINTER

Editor of "Air Trails" and author of "War Planes of All Nations" tells how Bell Aircraft has developed a spar milling machine that in twenty-two minutes does the job that once required twenty-four hours.

"THE Bell-designed spar milling machine is one of the great contributions this progressive company has made to speed up American aircraft production. Previous to the development of this mill, now being used by Bell and many other aircraft companies, it required twenty-four hours to complete a wing spar. Now these ingenious machines, covered by Bell Aircraft patents, turn out the spars for the giant Boeing B-29 Superfortresses being built in the Marietta Bell Aircraft plant in twenty-two minutes.

"The Bell spar milling machine, first developed in 1940, makes a cut two inches deep and four inches wide at the rate of sixty-five inches per minute.

"Under the old, slow method the material was fed into stationary cutter heads. In the Bell-designed mill the cutter moves across the metal, which is securely held to a bed by clamps that automatically drop down to let the cutting machinery pass and then jump up to grip firmly the spar behiud the moving section.

"Since the cutting head runs on a cam which acts as a die, the machine cuts any contour up to twenty degrees.

"Each machine is its own meticulous housekeeper, for streams of coolant pumped onto the high speed cutter heads sweep away the shavings and deposit them into a central salvage pit.

"The advanced design which Bell engineers have built into this spar milling machine are further evidence that American 'know how' is the prime factor that now makes this country the greatest air power in the world.

"And when V-day dawns, this same engineering ability will be utilized in producing peacetime products that will bring this nation better living and greater values."

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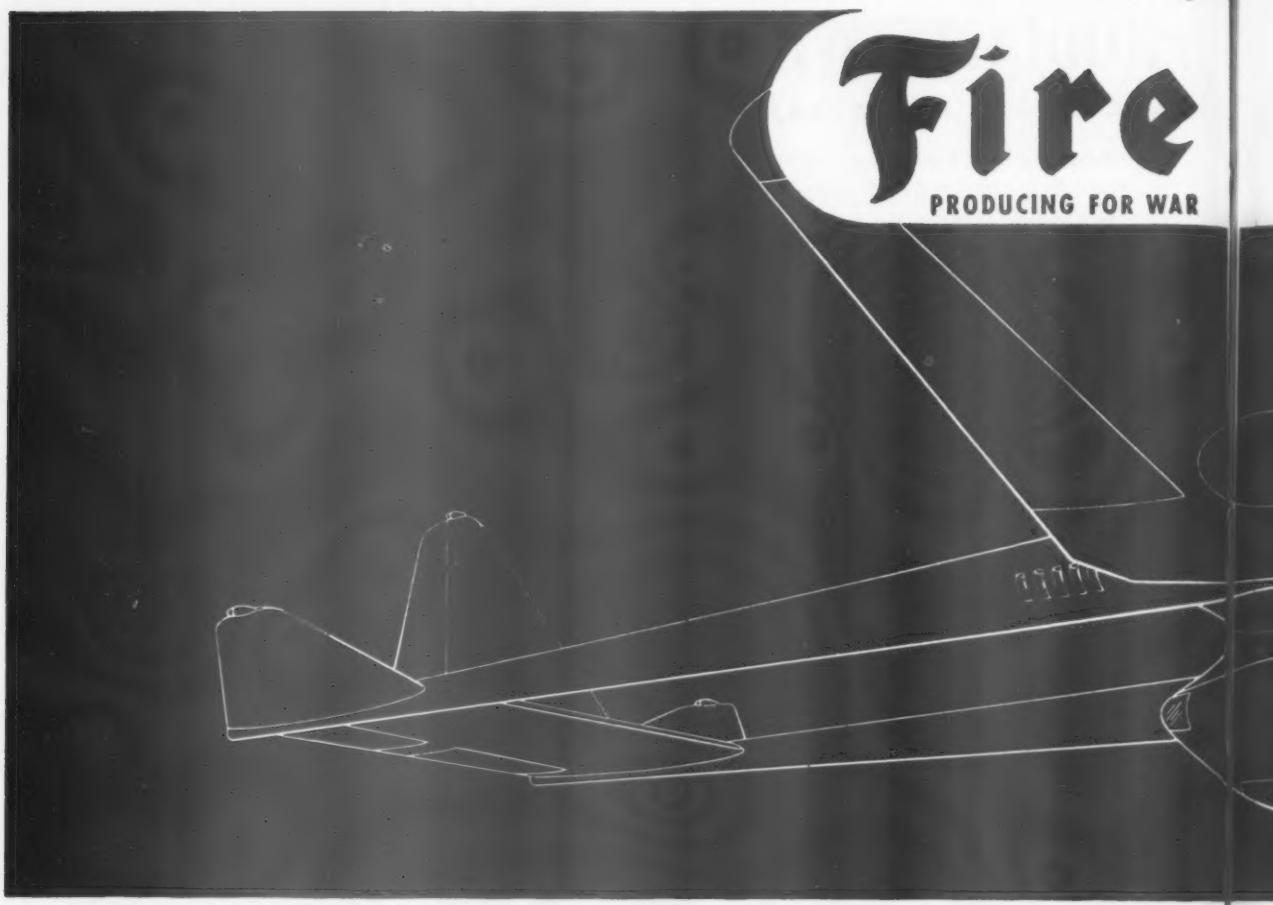

Give Your Customers a

. . . IN YOUR POST-WAR PRIVATE

YOU HEAR a lot of different opinions about the postwar outlook for the aircraft industry. Some people say that the number of private planes will grow like Jack's beanstalk. Others say that there just aren't enough people with money enough to buy their own planes and who are also able to pass the C.A.A. tests.

But one thing is certain — aircraft manufacturers are planning now to build private planes that are better and cheaper and safer than the prewar models. And one of the big improvements they are incorporating into their designs are Firestone wheel and hydraulic brake assemblies.

Equipped with Firestone Tires and Tubes, the Firestone wheel and brake assembly is, for safety and kinetic energy capacity, the lightest airplane braking unit on the market. In dependability it is unsurpassed — tests under all conditions have failed to produce a locked brake and it will not freeze in winter or overheat and grab in summer.

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. . . . MAKERS OF VELON SEAT AIRCRAFT SUPPLIES

(Continued from page 80)

most beautiful one, but its pilot probably will enjoy longer life.

GASOLINE SYSTEMS. Chafing against support straps and leakage at corner seams were occasionally reported in fuel tanks. Fittings in the bottom of certain tanks extend up into the tanks and trap and hold water along the tank bottoms. Corrosion results.

Gascolators have come in for their share of criticism, particularly because of the method of sealing the glass bowl against the metal top. Someone should invent a gascolator which may be readily adapted to the lightplane and which stays on tight. Wiring a knurled nut tightly to a slanting bail is a task for a magician. One wonders also how many airplanes are flying this day with the standing screw at the bottom of the gascolator bale in a bent and distorted and consequently weakened condition. No gascolator bowl —no power!

Failure to lock certain types of primer pumps after use resulted in several accidents through raw gasoline being sucked into cylinders during glides with power off.

LANDING GEAR. Frequent replacement of landing gear bushings was necessary during the WTS program. Ample grease fittings or sealed bearings might help—as might adaption of the automotive practice of rubber suspension.

Slide tubes generally employed in shock-cord type landing gears caused difficulty in several instances. Some type of soft "bumper" at the travel end and some type of bearing which provides for alignment, as well as the elimination of rubbing one tube against another, might go far in overcoming this situation.

Use of hydraulic brake systems on the majority of light airplanes is a great improvement, but several accidents were attributed to water, picked up while taxiing, which froze between the brake shoes and drums and locked the wheels.

Lack of tire anchorage to wheels has caused some difficulty when air pressure in tires has been allowed to fall below requirements. In such cases, valve stems have been pulled from tubes when the brakes went on. Of course, this would never have happened had correct pressure been maintained. But the human element must be considered if a trouble-free airplane is to be designed.

Research concerning tail shock assembly may in the future lead to development of a trouble-free unit. Reports indicate that when springs are "beefed up" sufficiently to preclude breakage, damage is caused to fuselage structure. The lesser of two evils is seemingly to allow the springs to break—which they do quite regularly.

ENGINES. Horizontally opposed engines, like the airframes, have as a general rule performed splendidly. Reports do, however, reveal certain difficulties which are enumerated here by component:

Idling: Engines stopped most frequently while idling in closed or reduced throttle operations. Instructions were released to offset this, but the problem was not eliminated. Aside from the human element, the most common cause of trouble was improper carburetor adjustment. Dirt and dust in idling passages was another; loose carburetor shaft bushings plus insecure carburetor mountings a third. In a few cases, ignition was blamed, as well as lack of proper oil and engine temperatures.

"Loading up" and stopping during glides can easily be eliminated by proper throttle manipulation, but redesign could automatically overcome such a tendency.

Rapid throttle opening on the small engines results in disturbance of the fuel-air ratio and may cause engine failure when the weight of the propeller is such that it will not flywheel for any protracted length of time. An accelerating pump would probably overcome this situation. It would, however, add to weight and cost.

Indications are that if all other conditions are satisfactory, icing difficulty caused by idling can be precluded by application of heat prior to closing the throttle when the engine is still delivering a comparatively large amount of heat.

Crankshaft: Crankshaft failures cannot be classed as chronic. The failures have occurred through crankpins, throws and at propeller ends. More attention to design and finish would result in overcoming nearly all such crankshaft failures.

Valves: Apparently the most vulnerable spot on exhaust valves is at the stem near the head. Research on such breakage should probe into whether forging defects, light design, overheating, improper spring arrangement or a combination of two or three of these are the contributing causes. Intake valves have generally broken at the airclip grooves near the end of the valve stem. Improperly fitting valve spring locks, sharp lock groove corners, material, clearance in guides, and valve springs, should be considered when steps are taken to eliminate breakage.

Cylinder heads: Failures of this component have been exceptional.

Crank cases: Crank cases have cracked both on those engines with cylinders cast integral with the case and on those which have separate cylinders. Apparently, two factors contributed to the failures—design, which permitted strain to be localized, and poor fabrication processes.

Spark plugs: Comparatively few reports on faulty operation of spark plugs were received, but it is believed that the majority of such difficulties were not reported. Cracked insulation, loosened center electrodes and fouling are common complaints. It is true that the plug is not solely responsible for all of these evils, but a combination of engine magneto and plug could be worked out which would insure trouble-free operation of these items for the normal period between engine overhauls.

Breathers: Serious trouble has been reported in certain cases where crankcase breather lines have been routed to exhaust into the carburetor intake. The purpose of this was to insure a clean installation. However, practice has proven that the cold air in the vicinity of the intake will often freeze the condensate present in the breather line and the line will become completely pluggd with ice, which causes high crank-case pressures. Likewise, venting of moisture-laden air into the carburetor is conducive to rapid ice formation during cold weather. In all probability, there will be designed some sort of trap which will catch crank-case vapors and also preclude stoppage of the vent.

Miscellaneous: The chain normally used to stop loss of oil filler neck caps has occasionally caused damage. The chains normally hang inside the neck and links of these have been broken, falling into the tanks. There they circulate with the cold oil until they reach the oil pump gears, causing damage to the gears or shaft.

It may seem that if the difficulties outlined above are corrected in future lightplane designs such airplanes will cost a fortune and their performance, due to weight, will be limited to running down some well-paved highway. On the contrary, there will be devised ways and means to produce low cost, well-performing, trouble-free lightplanes. The present ones are good—future ones must be better.

All the foregoing observations are those of the author and do not necessarily represent the views of the Civil Aeronautics Administration. END

5 YEARS AGO

FROM the March, 1930, issue of this magazine:

John B. Rathbun, pioneer aircraft designer and then managing editor, pointed out that the sales boost ex-Army pilots might have given aviation following World War I had failed to materialize. "The man on the street," he said, "is more than ever convinced that flying is only a circus stunt."

John W. O'Leary, erstwhile president of the United States Chamber of Commerce, cited statistics that showed "the automobile—in its 21st year—was 85 times as popular as the airplane in its 21st year."

The U. S. Bureau of Standards had approved a test for licensed aircraft engines which required a 50-hour endurance run at speeds ranging from 75 to 110 per cent of their speed ratings.

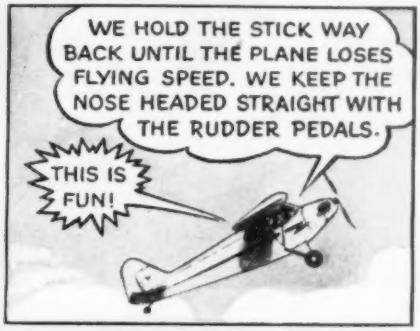
Rental of autos to transient flyers was advocated by the Alexander Aircraft Company as a means the fixed base operator might employ in expanding his services.

Hawaiian Airways, Ltd., had inaugurated inter-island service—using three-engined Fokke s—connecting Hilo, Honolulu, and Maui Island.

The Department of Commerce reported that 100 m.p.h. was the "most profitable speed for planes. At that speed, the ratio between operating expense, upkeep and payload shows greatest economy."

Ruth Nichols had just completed a 12,000-mile survey of the country's airports in a Curtiss *Fledgling*.

The Aeronca C-2 was advertised as a 400-pound job whose engine delivered 30 h.p. at 2,500 r.p.m. With cruising speed of 65 to 70 m.p.h. it used only two gallons of gasoline an hour.


WE HOLD THE STICK WAY BACK UNTIL THE PLANE LOSES FLYING SPEED. WE KEEP THE NOSE HEADED STRAIGHT WITH THE RUDDER PEDALS.
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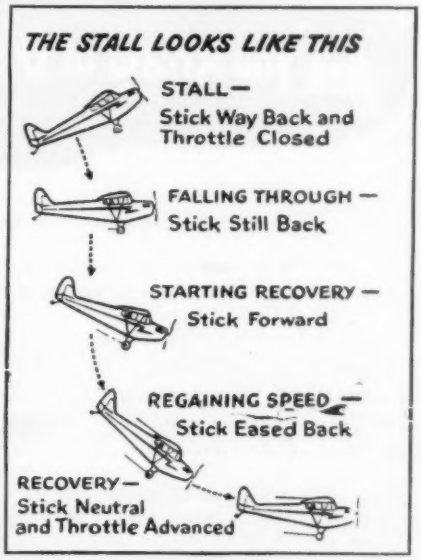
THE STALL LOOKS LIKE THIS
STALL— Stick Way Back and Throttle Closed
FALLING THROUGH — Stick Still Back
STARTING RECOVERY — Stick Forward
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RECOVERY— Stick Neutral and Throttle Advanced

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16 mm. SOUND FILM—"The Construction of a Light Airplane." For distribution points write: Supervisor, Audio-Visual Aids, Extension Services, Pennsylvania State College, State College, Pennsylvania.

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The 'Maytag Messerschmitts'

(*Continued from page 25*)

marizes the duties they performed: (1) they furnished a means of communication between the division commander and the landing craft and beach parties, (2) they kept the commanding general informed on the disposition of his troops on the four beaches, (3) they located enemy positions suitable for targets for Naval gunfire and (4) they assisted—through diverse liaison activities—in making the landing a success. The pattern thus set for the full employment of lightplanes has been followed in virtually every other Allied invasion down to the present time. The Sicilian invasion multiplied, moreover, the Army's method of getting lightplanes to the immediate theater of combat. Previously, liaison airplanes used in amphibious operations had either been flown down to the beach from a field within flying range or from a Naval aircraft carrier. But flying lightplanes to the Sicilian theater was impractical. The distance from Cape Bon Peninsula to the south coast of Sicily was so great that any head wind above normal would have made the flight impossible for lack of fuel. The entire flight would have been over open water with only a compass for navigating. Arriving too soon or missing the beachhead would certainly cause the loss of planes and possibly pilots. In addition to all these difficulties, the flight would have to be made at night in order to arrive at dawn.

Preview of these problems had determined five workable methods of moving lightplanes on amphibious operations: (1) flying the planes to the beach from a field within flying range; (2) flying them from a Naval aircraft carrier, or converting them into seaplanes by fitting them with pontoons or floats; (3) flying from a flight deck built on a landing ship tank (LST), (4) disassembling and loading the planes on 2½-ton long wheel-base trucks and loading both trucks and planes on an LST or LCT; and (5) deck loading.

Obviously, the two latter methods were impractical for invasion operations because of the time required in uncrating and reassembling. Nor was it possible to obtain the use of a Naval aircraft carrier. But permission was granted by the Navy to use an LST, and construction of a flight deck was begun by the division engineer battalion under the supervision of Captain Devol.

The deck was built in sections on the ground and then lashed to the top deck of the LST. The framework was built of lumber and the flight deck of sections of expanded steel matting. It was mounted down the center of the top deck, from the bridge (at the stern) to and over the bow 40-mm. gun. It was approximately 200 feet long, 12 feet wide, and 14 feet high, or level with the bridge. A test flight from the deck was made in a *Cub* on July 4, 1943, by Captain Devol, who was awarded the Legion of Merit for his part in constructing the deck and for making the test flight.

The superimposed flight deck did not prevent loading equipment on the top deck of the LST. Two lightplanes were tied down at the bridge end of the flight deck and two more were tied down on the LST's top deck. A portable ramp was constructed on which the two planes loaded on the top deck could be pulled up onto the flight deck. The planes were loaded from the docks onto the ship by a dock crane. There they rode out three days of rough weather on the way to Sicily.

The first two planes took off at the crack of dawn on "D" day. Both were equipped with SCR-609 radios tuned to operate with an SCR-608 aboard the division commander's flagship; one plane was equipped with a public address system to be used in directing landing craft after they had left their mother ship.

The planes took off in the face of artillery and antiaircraft fire and, during their flights, frequent enemy air attacks were made on the beachhead. Both planes flew about two and one-half hours, their maximum fuel capacity, covering the four beaches on which friendly troops were landing. If a false beach was discovered or it became inadvisable to land on a pre-arranged beach, orders from the commanding general altered the courses of the landing craft via the planes and their public address system.

Plans had been made to land a ground crew on each beach to select and prepare fields for the planes. But because debark-

(*Continued on page 89*)

U. S. Navy's Grumman Hellcat Completes a Mission

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COUNT ON
Curtiss-Wright
FOR ACHIEVEMENT IN THE AIR

(Continued from page 86)

ing operations lagged behind schedule, none of these ground crews got ashore in time. Both pilots were forced to pick landing strips from the air. They refueled from passing vehicles and continued their mission. They kept the division commander informed of the disposition of his troops on all four beaches at all times. Flare signals from the planes were answered by friendly ground troops with smoke signals—front lines and infantry command posts were located in this manner and reported to the flagship by radio. Several enemy installations were reported and Naval gunfire was immediately brought to bear on them. Friendly Naval gunfire falling on friendly troops that had advanced faster than planned was immediately spotted and stopped. Upon completion of their missions, the two planes were released to their respective artillery battalions to observe and adjust artillery fire. The two other planes aboard the improvised carrier were flown ashore about noon of "D" day to operate with their battalions.

Six planes used later in the Sicily campaign were transported to their bases via LST's and the two and one-half-ton trucks. The fuselage of each plane was loaded in a truck with the tail projecting over the cab and tied to the truck bumpers. "L" brackets of strap iron were bolted to the rack of the truck in such a manner that the rear spar butt fittings and the lift strut fittings could be fastened to the brackets. This held the wings in place. The control cables were left fastened to the ailerons and through the lift strut pulleys. The lift struts were wrapped in burlap and fastened to the bed of the truck. The rudder was carried inside the cockpit of the plane. All nuts and bolts that were removed were secured near their fittings with masking tape. With the brackets made and holes already drilled in the truck, it was found that the planes could be disassembled and loaded in about 30 minutes.

Upon landing in Sicily the trucks were driven ashore and moved inland until a suitable landing field was found. While planes were being assembled, each pilot located his battalion and picked a field nearby. By the day after invasion the battalions had spare airplanes to use when needed.

These planes were later flown to other beachheads established in the two amphibious flanking movements. Infantry divisions also used crating and deck-loading methods in transferring planes to extended areas of operation. Crating was found impractical because of the time required in re-assembly. Deck loading was more successful because the planes could be used almost immediately, but parts of the planes were lost in the transfer from ship to shore. Experiments were also made with pontoon-equipped planes, and unofficial reports indicated success under favorable conditions.

The Sicilian story has been told with some detail because the problems encountered there and the methods devised for solving them form a pattern which has been followed, with only minor variations, in almost all artillery air operations since that time.

Similar types of operation conducted by the Fifth Army in the invasion of Italy proved that the LST flight deck as originally devised was far more practical than the port-side deck constructed for the Italian campaign. Although the new deck provided more space for top deck loading on the LST's, the second plane to take off from such decks was caught in the updraft from the port side of the ship. Its right wing struck a gun mount on the bow and the plane was thrown into the sea. All other flights from the port-side decks were cancelled. In the Anzio landings the center deck was again in use.

The Piper *Cub* was most widely used in the type of aerial observation uses described here. For a detailed account of more strictly liaison operations, see "The Sergeant Flies His Jeep" in the January issue of FLYING.

The need for certain changes in the lightplane equipment and in its employment also became apparent in these early campaigns. A swivel seat was installed in the rear cockpit of some types so that the observer, a trained artilleryman, could swing completely about in the process of observation as well as handle the dual controls whenever necessary. A map table and two-way radio became standard equipment. The loudspeaker device was perfected for directing movements of ground troops.

When not in use directing artillery fire, *Cubs* handle the usual round of assignments that fall to the liaison plane. They are used extensively for personnel transportation and have done a considerable amount of limited supply work. Ingeni-

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ous gadgets were developed to aid in carrying out such tasks. One pilot rigged up a big leather bag for dropping supplies to isolated Ranger or Commando positions. As the bag dropped, a cord attached to the plane pulled open the supply pack chute. This device led to the development of the conventional supply packs now carried—one under each wing—of lightplanes. Special lightplane belly tanks were also built and attached for extended cross-country liaison flights.

Most amazing of the innovations in lightplane combat equipment has been the recent arming of certain planes used in France. Actual arms for the observation planes were long considered unnecessary because enemy craft had to get within 1,000 yards range to open fire at all. Their speed, plus the maneuverability of the lightplanes, made it impossible for the larger planes to get in more than a few ineffectual shots. Only by "ganging up" can enemy fighter planes ordinarily offer any real threat to lightplane operations. Even then the lightplane ability to utilize contour flying and any sort of landing area have kept it almost immune from fighter attacks.

But the comparative safety of the lightplane pilot even in the midst of enemy air operations apparently only added to his sense of ineffectuality. Early in combat operations, *Cub* pilots loaded hand grenades in their planes and flew close enough to enemy lines to use them. Some even tried their marksmanship with service pistols. Obviously, no great damage was done and pilots found themselves pretty fair targets for small arms fire. Weight of any sort of a machine-gun installation made that idea impractical.

Not until the battle for Cherbourg was a means devised to make the lightplane a serious armed threat. Lieuts. Harley Merrick, Richmond, Calif., and Roy Carson of San Francisco, two artillery operations pilots, dreamed up the novel idea during training in England.

"We figured we ought to have something to shoot," says Lieutenant Merrick, "and since a machine gun was too heavy, we got four bazookas from an ordnance salvage depot and went to work."

The bazookas were stripped of sight, grip, trigger, bracket and flash deflector, only the bare tube remaining. One was attached to the underside of both wings of the two planes and an electric trigger was rigged in the cockpit, enabling the pilot to fire the rockets singly or simultaneously. Tests were made on some old British tanks, and then the bazooka-bearing *Cubs* went into action for the first time against two German cargo trucks that Merrick and Carson spotted streaking along a highway in advance of the American drive. A rocket fired from one of the planes damaged both trucks, setting one on fire.

Later in the French campaign, Maj. Charles Carpenter, of Moline, Ill., attached six of the stripped bazookas to his *Cub*—three under each wing. Somewhere north of Nancy he dived on a concentration of enemy vehicles to score two smashed tanks, several destroyed armored cars and a dozen or so killed or wounded troops. While it's still pretty much of an experiment, numerous other bazooka conversions have been reported.

For a detailed account of the performance of these sturdy little planes, which the troops soon were calling "Maytag Messerschmitts," one may well turn to the men who fly them, those who first conceived and have directed the role the lightplane now plays in combat. Most of these pilots were lightplane enthusiasts before the war; all of them are skilled artillerymen. Their ingenuity in adapting these skills in building an effective air-ground combat team is the real wartime saga of the lightplane.

A veteran lightplane pilot who amassed more than 400 hours of flying time in North Africa and Italy, Capt. Eugene P. Gillespie speaks with authority on the developments in ground-air co-ordination. He took CAA training at Princeton in 1939-40 and was commissioned a lieutenant in the regular Army in October, 1942. He received his artillery liaison wings in the third class of lightplane pilots of Fort Sill, Okla., and was the first artillery operations flyer to be assigned to the Fifth Army. He helped develop the first artillery operations staff and its plans for the training of pilots and the use of small planes in battle areas. During his 13½ months of foreign duty he has piloted Generals Clark, Eisenhower and Alexander in aerial surveys of battle areas and has flown practically every type of mission that can be assigned to the lightplane pilot. Recently he returned to the States to instruct unseasoned troops in the use of the lightplane.

Describing this "indispensable tool of modern warfare" which he knows so well, Captain Gillespie says: "All these combat *Cubs* have 65-h.p. motors. Their range technically is set at three hours—but it actually amounts to 175 miles or about two and one-half hours. They should have more range but their greatest need is for more horsepower to increase the weight-carrying capacity."

Weight limits for the *Cubs* is supposed to be 340 pounds for passengers and 40 pounds for equipment. What such restriction means on a given mission is illustrated in Captain Gillespie's weight listing for his flights with General Clark. "The general weighs 195 pounds stripped," he points out, "I weigh 155. We both wore paratrooper boots, carried a 25-pound radio, an eight-pound pistol each, plus water, rations and steel helmets. Even this essential equipment totaled a great deal more than our specified capacity."

Captain Gillespie has nothing but praise for lightplane maneuverability, enthusiasm which is shared by General Eisenhower who holds a private license himself and occasionally took the stick during flights with Gillespie. It was during one of these observation flights that the general chose to land in an area where the only possible landing surface was a country lane. Gillespie said the general laughingly reassured him when he expressed reluctance about taking any chance with such an important passenger. The landing was made without mishap.

On a similar occasion, Captain Gillespie sought some 20 minutes for a suitable landing area in Naples after that city had

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As a flying boat, the *Mars* possesses greater inherent safety than landplanes for extended overocean trips. Then, too, its huge size and strength give the added assurance that if forced down it could cope successfully with heavy waves. More, it has demonstrated its ability to remain aloft on only 2 engines, its wings are sufficiently thick to permit the crew to service the engines while in flight, and the most modern safety devices of every sort have been incorporated in its design. In safety, as in payload and low operating cost, the Martin *Mars* is second to none!

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Most important of all, the *Mars* has been tested and proven in regular transocean service with the Navy. All "bugs" have been ironed out, all findings have been incorporated in the 20 larger *Mars* transports now being built. As a result, war's end will find Martin production lines completely tooled and manned for prompt delivery of these ultra-dependable aircraft. *Airlines and shipping companies interested in information on commercial versions of the Mars,* write: THE GLENN L. MARTIN CO., BALTIMORE 3, MARYLAND

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been taken by Fifth Army forces. He and his passenger, General Clark, decided upon a small park, with trees on one side and the waterfront on the other, that had to be entered at a slight curve.

"Sometimes you wonder how you'll get a *Cub* into or out of such a small place," Gillespie said in recalling the incident, "but they twist their own way. Even the smallest clearings make sufficient fields if the circumstances are urgent enough. It's this maneuverability—ability to whip around mountains at tree-top levels, to land almost anywhere—that gives them odds against any other combat plane."

An amazing assortment of combat stories substantiates Gillespie's statement. One of them has to do with a *Cub* pilot who played tag with a high speed German fighter over central France. The *Cub* hedge-hopped along the open country—with the fighter vainly circling above—until it reached Paris. There the pilot put his little craft into a tight spin right around the Eiffel Tower. He continued to circle the famous steel spire until the Nazi gave up in despair. END

A Story of Five Pilots

(Continued from page 49)

of his talk was foul, some of it was irritating—but all of it was direct and quirked with humor.

Mac was doing operational flying in an area just behind the combat zone. His *Avenger* was being readied to move up to the Russell Islands. Working out on dummy runs—coming down from 11,000 feet to 200 and roaring along at 240 m.p.h. to drop a de-warheaded pickle against a clumsily dodging LST landing boat—he scored two hits. After the second, his motor began to sputter. Mac swung around for an emergency landing place and picked what seemed to be a good one—a slash of white sand along the shore.

He came down to a landing in his heavy, fast *Avenger*. His wheels struck and stuck. The plane went over on its back like an upended turtle. The "sand" had been white, jagged coral.

The two gunners in the plane crawled out. They were jolted but unhurt. They looked for Mac and found him still hanging in his harness, head down. They cut him out and laid him on the beach.

There was not a mark on him but he was dead. The shock had somehow snapped his neck. "He looked pretty good," said one of the gunners afterward. "He always was a handsome guy."

Butch was a chunky, red-faced little pilot with a shaved head. He liked to play on the wall piano in the lounge of the Dutch ship that took us across; there, in the midst of the fine veneer and the ship's library (which was always locked up but it was all right since it was in Dutch anyway), he pounded out his one-fingered version of his favorite tune, "Under The Spreading Bamboo Tree":

Under the spreading bamboo tree,
Oh, how happy we will be!
When I love you, and you love me;
Under the spreading bamboo tree . . .

We talked about snakes one night on the blackout watch and vied in horrible anecdotes. Butch, who came from the middle west, listened in terror. At two that morning he woke his mates with a horrendous scream. After they ascertained that it was not a torpedo but a nightmare, Butch was asked with some disgust what it was all about.

"I dreamed," he said with disarming frankness, "that I was tied to a post and people were throwing rattlesnakes into the air. They were falling on my bare head."

He had an excellent high tenor voice and a fund of irresistible puns and jokes. He came from a town so small that everybody knew it when he came home drunk. Nothing appealed to him so much as flying and fighting.

On his first combat patrol north of Guadalcanal something happened. No one knows what it was. His mates were busy fighting off a swarm of Zeros when they saw, out of the tail of their eyes, a *Corsair* start to smoke and flame. It went straight in and disappeared, a creamy boil in the blue waters of the Pacific. They found out it was Butch when he didn't come back.

There was Nat. His girl called him "Slim" in her letters for no reason that I ever knew and we called him "Nat," which he preferred.

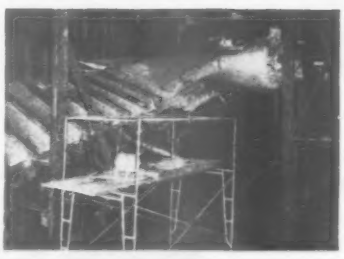
He came from New York. He was lanky and blond with an angular face and a complexion which sometimes broke out into pimples. His family was well-to-do and Nat had been able to enjoy a lot before he went to fly and fight. His girl had long dark hair and big eyes; she belonged to the Junior League and worked for the Red Cross. Nat said she had a slight Harvard accent and he was sorry about it but he was in love. "The hell with the broad A's," he said.

During the long blackout watches on deck he liked to talk. It was very small talk, mostly about things left behind: girls, ice cream, lights, movies. Sometimes it was close harmony and Nat sang a fair first bass. Sometimes it was philosophy or a technical aeronautical discussion.

After a little training in a rear area, checking out in *Corsairs* from the *Wildcats* with their chunky bodies and square wings, Nat went into the advanced combat area with his squadron. That was Henderson Field on Guadalcanal. The squadron did not stay there very long; Henderson had become a comparatively peaceful place full of dust and arriving Army units and rows of planes belonging to everybody from the clannish New Zealanders to photographic officials. There was a shower by the Lunga River and Spam was on its way out.

Nat's group was one of the first to get into the Russells. He lived in a square green Dallas hut by the road that bisected

GHOST SHIP



FIRST of the four original *Superfortresses* built by Boeing Aircraft, this ghost plane returned to life after being demolished in the torture chambers. To obtain strength data, the wings were crumpled under load (right), the body racked and pulled down on both ends until it broke at the rear turret in a jagged tear. Similar tests battered the entire tail assembly, ailerons, wing-flaps and other components.

Finished off with 20-mm. cannon fire in gunfire tests, the remains were passed on by the Army as junk for "disposal and salvage." Rather than see this veteran, formally known as XB 1001, be junked, men of the B-29 school begged, borrowed and made parts for it during their spare time. Reassembly gave AAF men at the school field repair experience.

POST WAR AVIATION OPPORTUNITIES Bulletin

VOLUME 1 NUMBER 5

Airlines Expect to Have Openings for Air-Cargo Personnel

Postwar expansion of the many airlines of the U.S., both domestic and international, is certain to mean numerous jobs for air forces personnel who are trained in handling, stowing and dispatching cargo.

In fact, both the A.T.C. and N.A.T.S. have had considerably more experience with air freight on a volume basis than have the airlines. For this reason, the lines are especially interested in securing personnel from these organizations.

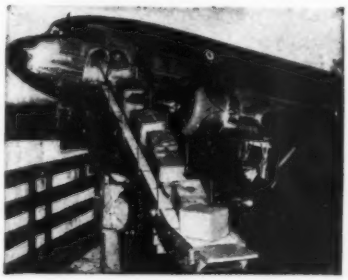
OPENINGS

In general, the airlines will have openings for three broad classifications:

1) **CARGO HANDLERS**—men skilled in stowing and tying down material so as to prevent shifting or vibration in rough air. Know-how in packaging assorted bulk articles to prevent spoilage or damage in transit is also valuable.

2) **OPERATIONS AGENTS**—personnel who know how to route cargo and direct loading and stowing operations, and who are responsible for over-all weight distribution of plane—gasoline, cargo, passengers, etc.

3) **SALES ENGINEERS**—Here, the airlines want men with previous experience in jobbing, shipping, and retailing.



LOADING CARGO *via automatic conveyor on an American Airlines "Airfreighter." An innovation in airline operation, these are the first planes to haul cargo exclusively, no passengers being carried.*

For example, with some additional training by the lines, a former produce man with air force experience would be able to go to a farmer and show him how to reach better markets and profits shipping by air. These men will be the salesmen and sales promotion experts. A knowledge of public relations or sales experience will be of assistance.

EXTENT OF POSTWAR FIELD

It may be said that the airlines and feeder lines will be of postwar importance to any industry where time is important; since time, rather than transportation, is what the airlines are really selling.

Any industry having items subject to rapid market fluctuations or of high depreciation, including perishables, will always be interested in saving time between producer and consumer.

ONLY THE BEGINNING

No one doubts that peace will bring a great expansion in this field—an expansion that will require trained cargo personnel from the air forces to sustain and help promote it.

The fifth in a series of bulletins designed to acquaint ground and flight personnel of the Army, Navy and Marine Air Corps with new developments in the field of commercial aviation. Union Oil Company does not believe the war is won, but we do think many members of the air forces are wondering what they will do when peace comes. We believe they will be interested to know of any opportunities which exist for them. Inquiries are welcome, and we will be glad to furnish information to interested personnel. Address—Aviation Dept., Union Oil Company, Room 700B, 617 W. Seventh Street, Los Angeles 14, California.

AVIATION DEPARTMENT
UNION OIL COMPANY
OF CALIFORNIA
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the main island. The hut was under the palm trees and falling fronds and nuts were a real danger; one nut crashed clean through the roof one night but no one was hurt. Fifty feet away there was a huge foxhole roofed with 12-inch palm-logs and buttressed with more of the same, entered by a sliding hill of red dirt. There was jungle but it had been eaten back by the cattle on the island put there by the French *habitants* who had been there before either the Japanese or the Americans. Most of the cleared space was sod, made springy as sponge rubber by the network of palmroots immediately under the surface: it was the best spot in the South Pacific—and the hottest at that time.

Nat's three roommates were Connolly, a redheaded Irishman who did his job very well and complained about it. "Jesus," he said one day coming back from an escort mission over Kahili, "know how I feel? I'd like to find a poor weak little fellow with a broken arm. I'd like to beat the hell out of him." Those days Kahili was a very strong and very much alive nest of Japanese planes and antiaircraft. The pilots used to report that flying over it was a good deal like flying into a Bessemer converter.

Hack was another roommate. He was a sharp-faced, tanned little man who knew the strategy of flight better than his own name. The others liked to fly with him because he always took care to carry out excellent protective maneuvers as well as a good cover mission. He was an ace. Once he got drunk and wrote a letter to his home town pastor—in whose church he had appeared exactly three times in his life—denouncing organized religion. To his astonishment and rather sullen confusion he got a letter back admitting his charges and asking for advice. He did not write again.

Lying down under their mosquito nettings, letting the fat drops of sweat curl down their legs, soaking their skivvies, they liked to talk. Sometimes they looked at the pictures of their girls (Hack was married, had been married six months); sometimes they exchanged letters; sometimes they read poetry aloud from a collection by Mark Van Doren. But mostly they talked.

Once they talked about medals. Hack wanted one because he wanted a child and it would please the child, he thought. Connolly wanted one because it was a good thing to show the girls.

Nat didn't want a medal. "It doesn't mean a thing to me," he said. "I wouldn't wear it if I got one. I'll do my job and then, when the war is over, I'll kick the moths out of my civvies and get back into civilian life."

He asked his girl to marry him by mail. She accepted and the engagement was announced in the New York papers. Nat was excited over it and ordered some cigars sent up from the rear bases to hand out (he didn't smoke) but they never arrived.

"S-s-seven, e-e-eight, n-n-nine . . ."

They lived together and went on their dawn missions and their noonday missions and their evening missions. They slept as much as they could and played checkers in the ready tent and reported in to their squadron commander as required. They went swimming in the bright waters off the island and lay in the sun. At night (for at that time the Russells were being bombed sometimes six times in a night), they waited for the sirens and ducked out through the warm night to their shelters and cursed and waited for the spasm in the sky to pass.

At last Munda was captured and they moved north again. They went to Sydney, Australia, for their rest periods of 10 days or two weeks and returned to the combat area. At last it was time to go home and three days to go on their third and last tour.

Nat was flying wing on his section leader on the way home after a raid from an advanced field. The Zeros struck from cloud cover. The section leader had his own trouble covering up and he did not see Nat. The others did, though, and they reported that he had been shot down and his plane had crashed into the water.

What was Nat, however, is what he said one night in the foxhole.

"I want to get back," he said, "because I want to be normal again. I don't want anything fantastic or unusual—I just want things to be half of what I remember them to be. That doesn't mean I want to go back to what there was or jump into a world of plastics, prefabrication and pap." He fumbled a little there as if he was unsure of what his words conveyed, though his thoughts were tough and exact.

"What about the four freedoms?" someone asked from the darkness and the smell of earth.

"I don't think freedom can be divided like a pie," Nat said slowly. "I think it has to be whole and indivisible—my own freedom, anyway. But that's part of what I mean by being normal." His voice brightened. "You remember they used to talk about the American dream?" he said. "Something like that."

"House, kids, the 8:07 train, good liquor and a show?" said another voice with heavy sarcasm.

"I can't talk for anybody except myself," said Nat doggedly. "I don't think anyone should. Maybe I can put it this way." He was deadly serious and they knew he was thinking.

"I'm *for* these things," he said at last. "I'm for the individual and I mean that in the absolute sense of the word. I'll co-operate, sure, but if it's a choice I'll be the lone wolf. I'm for religion but it hasn't filled any particular need in my life so far. I'm for kids and good food and some fun—and some thinking, too. All that makes sense. We've always said we didn't want any territorial expansion out of this war but we had better get some spiritual expansion.

"I'm *against* anything which interferes with those things—against organization—I don't think I'd even join a fraternity if I had to do it over again—against crying, fear, and unhappiness."

Nat stopped there. It was a bad place

"Seabee" Balaban and his father helped build many a Studebaker in peacetime

Studebaker's Joe Balaban has another son and a daughter in the Navy—Like thousands of Studebaker automotive veterans, Joe Balaban now works in one of Studebaker's aircraft engine plants. Other Studebaker automotive veterans build heavy-duty Studebaker military trucks and Weasel personnel and cargo carriers.

KEEP ON BUYING WAR BONDS AND KEEP ALL THE BONDS YOU BUY!

And they're comrades in craftsmanship still

THE whole nation is justly proud of the accomplishments of our Navy's fighting construction battalions known as the Seabees.

One fine example of the resourceful Seabees at their best is First Class Seaman Milan Balaban of South Bend, Indiana. He learned his way around with tools as an apprentice millwright in the Studebaker automotive plants—working close by his father who has been a Studebaker employee for more than 26 years.

Today, Joe Balaban, the father, is putting his skill and experience to good account in the Studebaker Aviation Division—from which tens upon tens of thousands of Studebaker-built Wright Cyclone engines for the famous Boeing Flying Fortress have been steadily streaming forth.

It's largely because of the painstaking craftsmanship in peacetime, of numerous Studebaker father-and-son teams like the Balabans, that wartime America is getting such dependable performance from Studebaker motor cars and motor trucks.

Awarded to All *Studebaker Plants*

STUDEBAKER

Building Wright Cyclone engines for the Boeing Flying Fortress—heavy-duty Studebaker military trucks—the Weasel personnel and cargo carriers.

to stop and he knew it. He tried to finish what he wanted to say: "All that is general as hell but every guy knows what it means. He has the music if he doesn't have the words." That was all because the raid was over.

Dave was the best pilot of the group. He had had a lot of operational experience and he handled his plane very well and smoothly. The other pilots would rather have flown with him—wing or section leader—than with any other single man. When there was an informal vote as to which was the best suited to combat work, those grim little caucuses which were often held because they were as near as a flyer could get to talking about whether he would come back, Dave always came out on top.

He always deprecated this. Not too much, because that would look like false modesty. But he would wave his hand and say: "Let's have a game of chess." He really liked chess but he wasn't too good at it. It would be too much of a generalization to say that no fighter pilot is good at it but most of them aren't—their peculiar talent lies in their physical reflexes and mental abstractions seem to cloud the former.

At any rate, Dave, with his big hooked nose and his almost finicky concern over his clothes, his thin, brown, waved hair, was as well liked or better than any other man. Any pilot in the group would have offered odds that Dave would come back with his northeast corner filled up with ribbons.

He didn't. He was one of the first lost. It was one of those mystery affairs, a scramble far out over the water at dusk, a melee of planes, Zeros and the gull-winged *Corsairs*. It was over in seconds but Dave did not pick up his place in the returning formations. They waited at base for him but he did not come back.

The rest of the squadron thought it was too bad. He had been eager to shoot down a plane but he had been more anxious to hear from his girl. He had not had a single letter in three weeks. That was what his mates thought of as too bad; the letter arrived two days after his name had been transferred to the casual company lists.

Milt was a quiet little fellow. He came from New Jersey and his hair receded until he had only a small blond scalplock. He, too, was an excellent pilot, a "natural" flyer, but he was completely unaggressive. He didn't like to fight but he would not shirk it if it came. Nevertheless, he never got an enemy plane.

He had his troubles. He endured a prolonged attack of malaria followed by jaundice. It was a common complaint at the time; Milt was left as yellow as buckskin. His eyes cleared up but his skin retained the pigmentation for a long time. The worst part of being sick, he said, was hauling himself (wrapped in a blanket) in and out of the hospital bombshelter during the night raids.

He wanted passionately to take a trip on a 30-foot ketch he had stowed away in Florida, after war, down to the Cocos Islands off South America and look for buried treasure. "Just sail along and not mind anything ever again!" he said. He sighed. "Gosh, that would be wonderful!" He never swore.

He looked very sound and practical, like a solid bit of timber, but he was a riotous idealist. If he liked a person he tried to ingratiate himself with a shy grin.

He came near death one night when he landed on a makeshift strip. It was at twilight and the visibility was not good. Unfortunately, a crew had been digging a hole in the middle of the runway for unexplained reasons and had not put out warning lanterns. Milt hit it, bounced, the *Corsair* sprang into the air and he gunned it enough to bring it down again in control. "Hope I never come closer to it than that," he said.

He did. He came home three times shot up from protecting his fellow pilots. Then he didn't come back. Antiaircraft picked him off over Kahili. The rest saw him go in, engine silent and dead, and vanish into the waters of the bay off the island of Bougainville.

There was a song they used to sing on deck during the long watches. Hearing it, the men sleeping atop the hatches through those hot nights would sleepily applaud. It had a slight, mournful tune and its words were these:

Blackbird, singing on a tree,
Bids his love farewell;
Sad and lonely pipes the breeze
Singing Lorelei!
Lorelei . . . Lorelei!
Maid with golden hair;
Sunshine came along with thee
And swallows in the air.

Mac in the bass, Milt and Butch with the tenor, Dave and Nat sitting and listening. It is strange that it would be the thing that would be most memorable—a song—but that is what has touched the recollection and has kept it fresh. Sunshine and swallows and a maid with golden hair, and five men who disappeared in the search. END

THOSE DC-3 VERSIONS

THE chief differences in the C-47 and the C-53—the two versions of the Douglas DC-3 used most extensively by the Army—are related directly to the purposes they serve. The C-47 *Skytrain* (shown above) was designed for heavy cargo duty as well as troop transport. Doors designed for passengers—like those of the old C-53 shown at right—were broadened and moved farther back in the fuselage. A heavy metal floor, equipped with stronger braces and tie-down provisions (below, left) replaced the plywood floor of the C-53 (right)—wooden bucket seats devised so that they could be folded into the wall took the place of the permanent metal ones on the C-53. The tow cleat for glider towing, formerly an exclusive feature on the C-53, was made interchangeable for both of the transports.

Both planes are usually powered with Pratt & Whitney 1,050-h.p. engines, though interchangeable mounts make use of other engines possible. Gross weight of both is 25,200 pounds, but the C-47 is frequently flown at over 30,000 pounds. It will hold two jeeps, or three airplane engines in boxes. The C-53's troop-carrying capacity is normally 28, plus a crew usually comprising four members.

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(*Continued from page 66*)

sprayed with oil. He's so busy doing the breast stroke so he won't drown that he forgets he is flying and all of a sudden the ground comes up hard as hell and wh-a-am!"

The red-headed sergeant wasn't far wrong. The oil tank was foaming over in flight, dousing pilot and plane with oil. Some guy who had hoodwinked the RAF boys into believing he was an American airplane engine expert had made some modifications on the *Warhawk's* Allison engine and these were causing the oil baths as much as anything else.

I crawled around the ship's engine for a while, getting madder by the minute when I'd seen what this blacksmith had been doing to a perfectly good power plant. Finally I let him have it with both barrels. "If you're an airplane motor expert I'm a whirling dervish!" I bawled, brandishing a wrench in his startled face.

He'd installed an oil tank breather, or vent, which ran from the front side fire wall fitting into the nose section of the engine and opening directly on the propeller main thrust bearing. This masterpiece not only made matters worse in regards the oil spray difficulties but contributed to a rapid corrosion problem on these planes. Engines vented in this manner corrode seriously because fumes from the top of the oil tank are heavily laden with corrosive elements.

I disconnected his brain child and made a couple of simple adjustments that completely overcame the problem. The first was to make sure that the level in the oil tank did not exceed 9.6 gallons on the oil level indicator stick after the engine had been run and the anti-corrosion oil had warmed up enough to mix with the engine oil and then drained out and filled with fresh oil. I also made certain that the oil tank filler cap was a tight fit on the spout, as some of the caps had a tendency to fit sloppily, admitting air which would build up pressure. No problems after these changes.

I stuck around Takoradi for a while, cramming the ground crew there with as much airplane knowledge as I could and then flew to Abu Suier in the Suez Canal zone where *Warhawks* were assembled after being unloaded at Suez. There was a bunch of Australian mechanics and ground crew men stationed there who were really eager to learn what made the plane tick.

I set up a school in the camp's movie house and conducted daily lectures. About 100 men attended each lecture and those boys really ate the stuff up. They were getting out one plane every 36 hours when I left, which isn't too bad considering the spare parts situation.

Good old spare parts! If service men have a nightmare it's spare parts. In most cases they just didn't exist. If there hadn't been some crack-ups there wouldn't have been any spare parts at all. Whenever a plane washed out we'd pounce on the thing like hungry cannibals.

I received a hurried call from the RAF to shake my tail down to Alexandria as they were having an overdose of machine-gun trouble.

I hooked a ride on a transport plane that had been loaded with a slide rule by a young Army engineer just out of training school and who was horrified to think that I should presume to upset his mathematical calculations. He finally reduced me to the least common denominator and decided that I could occupy the space originally intended for a case of beans. I felt like a sardine by the time I reached Alexandria but I got there.

The RAF at Alexandria had about one plane out of 12 with all six guns in operating shape. The pilots were practically gibbering. They'd get up quick enough when enemy planes came over, fire a few shots before their guns jammed, and then high-tail it for home. It was very embarrassing.

"If you fix those guns so that I can fire one continuous burst at some of those lop-eared Jerries I will line up the bar at Cecil's from one end to the other with your favorite drink," pleaded one young RAF fighter pilot, who later turned out to be "Killer" Caldwell, the Australian ace. "Just one steady burst!"

Ripping those guns out was some job. Alexandria was being bombed considerably. I'd just get going nicely on a dismantled gun when the alert would sound and I'd have to reassemble the gun and stick it back in its sheath.

I found the guns in a very poor condition. Most of them still had the original grease applied before leaving the States. They'd collected sand and dirt all the way across and by the time they reached Alexandria from Takoradi they were really jammed. When we dismantled them it took two men to pull the actions out of the frame. A pilot watching us said: "Cripes! It's a break I didn't catch that Jerry I chased away last night!"

Proper cleaning and a little mechanical work was all those guns needed. We breached the action and filled the buffers with oil and with regular attention they performed satisfactorily.

The next time the Germans came over was one of the most soul-satisfying moments I've ever experienced. They had been flying over prior to that with an almost mocking indifference. They had a rude awakening.

It was a night with a full moon and they looked like black ghosts up there until the searchlights proved that they weren't anything but Junkers. They were after the English fleet in the harbor this time and the sea wall was the closest I could get to the show without swimming. I sat there with my legs dangling and yelled myself hoarse as the *Warhawks* rose to meet the enemy. It was short and very sweet.

Three Junkers went down in flames. They made a great splash in the bay. The rest fluttered around like bewildered roosters and then high-tailed out toward sea with the *Warhawks* after them. They got another Junkers before they lost them in a cloudbank up near the moon.

I was waiting for them when they landed and spotted the young RAF flyer who'd pleaded with me.

I said: "Nice show. Let's go."

"Go?" he said, "Where the hell to?"

I had his arm now. "To Cecil's" I

SOLAR STILL

THE AAF's new "solar still" provides aircrewmen adrift at sea their drinking water as long as there is sunshine.

Prepared for use with lung power, an inflated vinyl plastic envelope has a plastic screen covered with black cellulose sponge stretched through the middle. Soaked with two quarts of sea water it absorbs the sun's heat which evaporates the water leaving the sea salt in the sponge. The envelope being cooler, condenses the water vapor which collects in the still's reservoir as distilled water. Six stills assure one pint of water daily for each of the six men a multiplace raft will accommodate.

A FOXHOLE TENANT HAS SOMETHING TO SAY!

Ever spend a weekend in a foxhole . . . No? Well . . . until you have, it's pretty hard to understand what those lads in "that wild blue yonder" really mean to us guys slogging along in the mud . . . Here's a quickie . . . so you'll see what I mean. Back around what the folks at home call Holiday Season, our outfit is makin' time towards Mr. Siegfried's line, when the weather decides to turn zero-zero . . . Then, a foxy gent named von Rundstedt threw the works at us, all schedules for Berlin went haywire, and speaking for our cocky spearhead in particular, we dug right in fast . . . and just tried to stay alive . . .

For three long days . . . and longer nights . . . we were cold, hungry, miserable, and let nobody kid you . . . scared . . . plenty scared . . . for old man despair sure clamps down when you're forced to sweat it out that way . . .

. . . Late the third day . . . it seemed a year . . . the pea soup drifted away, the sun poked thru the

clouds . . . and then . . . man oh man those Thunderbolts came down. . . . . Prowling tanks and cunningly hidden machine guns just went right out of business . . . road blocks that had held us helpless went the way of the other horrors . . . Heinie's fire began to slack off, and those of us who could, crawled out, got organized, and went into high once again. Me, I'm an infantryman, and that's the top outfit in my book . . . but I gotta hand one thing to those *buzzards . . . when it comes to paving the way over a tough spot, they're the all time, all American steam rollers.

*** REPORTS FROM ALL BATTLE-FRONTS STRESS THE VITAL CONTRIBUTIONS OF THE THUNDERBOLT TO EVERY PHASE OF COMBAT....**

REPUBLIC AVIATION
CORPORATION

Makers of the Mighty Thunderbolt » » » *Farmingdale, L. I., N. Y. • • Evansville, Ind.*

grinned. "You and I have a date with a hangover!"

That was quite a night.

From Alexandria I flew to Lydda, Palestine, on a hurry-up call from RAF headquarters and reported to the C.O. of an Australian *Warhawk* squadron which was going on daily patrols with questionable guns. He was tall and wiry and tough. He flew with his men and they loved him. Once he got so mad when his guns had jammed that he batted a German ship out of the sky with his wing tips.

He got into coveralls and helped me with the guns, he was that anxious to get them working right. It was the same story. Dirty guns. We went to work. I gathered the armorers all together, gave them the low-down and we started cleaning, adjusting, filling buffers and tightening the fibre discs.

Lydda was quite a hot spot. The Jerries came over regularly and dropped bombs in a hit-or-miss fashion but while I was there I didn't see them do any damage. They came over at night mostly and either they don't eat enough carrots and can't see well at night or our camouflage was better than we thought it was.

The afternoon I left Lydda the Australians really got hot. Some Junkers came over and the planes high-balled up to meet them. They shot down three Junkers Ju-88's. Two others were hit and when last seen were smoking and losing altitude fast. The C.O. was jubilant. He pranced all over the place like a two-legged colt. "Mister," he said, "watch our record from now on in!"

Several days later I heard that the Aussies brought down a couple of Martin *Marylands* held by the Vichy French Air Force. The Aussies reported that the *Marylands* had a blind spot in their lower rear left and right quarter sections which made them easy meat for the hard-hitting *Warhawks*.

Of course it wasn't only the mechanics who were laboring under difficulties. The stories I heard about American troops building airports in North Africa illustrates the sort of troubles we all had. One group of engineers under Maj. Terrence S. Lighthouse, Houston, Tex., had had its heavy construction equipment taken by a U-boat. Nevertheless, with every native it was possible to hire, wood- and charcoal-burning trucks hauling graders and scrapers, and a deadline to make, they built a runway in 20 days.

Another group, after lightering 11,000 tons of equipment ashore, built a 6,000-foot hard-surfaced runway in 60 days, in hard lava which used up all their drill steel and 55 tons of dynamite. Because the area was spotted with bird droppings, they camouflaged their buildings and installations by painting them with a lava dust mixture dotted with white paint.

I went back to Cairo and made a report to the American minister, Alexander Kirk, who had received a request from the State Department for a consensus on Curtiss warplanes in the area. I batted it out and then sent a detailed report into the home office which, among other wails, groused considerably about the spare parts situation. I wrote at length about the machine-gun trouble and passed on other service information I'd picked up.

After that I really traveled. I flew down to Alexandria and worked on Brewsters and Grummans for the Fleet Air Arm stationed at the Dekhelia airport. I'm a Curtiss-Wright service man but during those early days I worked on everything. Most of the other aircraft manufacturers didn't have men in the field.

From the Dekhelia airport I flew to Abu Suier and worked until a plane from Cairo took me to Gaza, Palestine, where the *Warhawks* were having trouble with their landing-gear struts.

I fixed the landing gear trouble by simply telling the RAF pilots to land easier. Some of those lads would ram the ship in like a ton of bricks. "I like to bounce," one boy told me.

Flew back to Alexandria and inspected a *Warhawk* engine that had piled up 150 hours. It was in good shape outside of some bad plugs. I patched up some bullet holes, tinkered around for a while and the *Hawk* went back into service. The plane proved it was still a gay young dog by knocking two out on its first mission.

Back to Cairo and then to Port Sudan to help supervise equipment erection. Then to Fayid, where the Fleet Air Arm was about to put its Grummans into operation. I checked their guns and engines, put them in shape and flew back to Cairo. From here to Abu Suier by plane and arrived just after the place had been heavily bombed. They stowed me promptly on a military plane and I ended up in Rayak, Palestine, where a squadron of *Warhawks* was having dust trouble. I doctored them and returned to Cairo.

The RAF was anxious to get their *Mohawks* at Nairobi in shape to help clean up the Abyssinian campaign on the French Somaliland border and at Gondar but they were having scavenger pump trouble.

The planes were losing their oil pressure and after the engine stopped we would find the crankcase full of oil and the oil tank empty. Some ceased to scavenge entirely after a few hours running time and the RAF had grounded the planes, which is very bad.

I thought at first I'd located the trouble when I noticed that the fine mesh screen around the bleeder by-pass would be all compressed up and I deduced that the screen was closing up the bleed hole. I took the screen off. It made no difference.

Starting out on another tangent I removed the disk from the tip which has the metering hole in it and also the small flapper valve beneath it. No soap. A service man can feel when he's on the right trail of trouble, however, and I kept on. I removed the steel pin running up through the valve and cut the valve stem off between both portions of screw threads. We tried it and it scavenged.

The oil temperature was high, however, and after fussing around for awhile we found that by enlarging the metering hole in the center to 3/64 of an inch and notching the flapper valve beneath the disc with the metering hole in it allowed air to escape more easily and the pump scavenged properly. I went with these planes into Ethiopia where I spent three weeks in the desert. I also got lice.

I wasn't particularly angry when I got an urgent call to get back to Nairobi. The squadron couldn't spare a plane so I came through the wilds and desert via a motor convoy, which is no fun. The sun shines down hot as hell. The bugs bite. The trucks get stuck and you shovel. It was very rough going and I wished that young RAF pilot was along who said he liked to "bounce" *Warhawks*. He would have enjoyed the trip.

Reaching Dire Daua, I rode on a Diesel train to Addis Ababa where I emerged from the station looking like a shaggy wild man from Borneo. I didn't pause long enough to shave, and hooked a ride

the British Say . . .

DEVELOPED from the Lockheed *Ventura* (PV-1), the Lockheed *Harpoon* (PV-2) has a "solid" nose, beneath which is mounted a battery of rails for firing rockets . . . The following specifications are quoted for the Bell *Kingcobra* (P-63): span, 38 feet; length, 32 feet; height, 9 ft. 8 in.; empty weight, 6,000 pounds; gross weight, 8,150 pounds; top speed, 390 m.p.h.; service ceiling, 35,000 feet; tactical radius of action, 375 miles . . .

The all-gun version of the *Flying Fortress*, the Boeing B-40, has been dropped from service because it was found to be too slow to keep up with bomber formations it was supposed to protect . . . A version of the North American *Mustang* now is fitted with a Rolls-Royce *Griffon* engine . . . The 1,260 h.p. Rolls-Royce *Merlin* is an alternative engine for the *Kingcobra* . . . The following new American fighters were named: the McDonnell XP-67, Grumman XP-65, Vultee XP-68 and Republic XP-69 . . .

Over 5,000 Bell *Airacobras* have been sent to Russia under Lend-Lease . . . Grumman is reported to have a four-place, high-wing, pusher amphibian for the post-war market . . . The RAF is using Stinson *Sentinels* in Italy . . .

—THE AEROPLANE SPOTTER

A version of the Curtiss *Helldiver*, the XSB2C-2, was equipped with Edo floats . . . The photo-reconnaissance version of the *Mustang* is known as the F-6 in the AAF . . . Radio-controlled bombs, similar to those used by the Germans (V-1), were reported to have been used by the Allies against the Japs at Rabaul . . . The General Motors FM-2 is the *Wildcat VI* in the British Royal Navy . . .

The following information was given for the Bell *Airacomet* (P-59A): "The maximum thrust from the two petrol- or paraffin-driven turbines is available 30 seconds after starting. The *Airacomet* weighs more than five tons, has a span of 49 feet, and carries a comparatively light armament of four .50-cal. machine guns" . . .

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The TCC carries our paratroops into battle, tows gliders filled with men and equipment, rushes supplies to the fronts and evacuates all of our sick and wounded.

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on a Fairey *Battle* to Nairobi, which turned out to be the lalapaloozer of all rides.

This plane had seen plenty of action. It had been shot so full of holes that I was afraid I'd catch pneumonia from the drafts. But that was the least of my worries. En route, a gas line sprang a leak. The gas line was just over my head and the gasoline sprayed all over me, soaking me to the skin. I was under that gasoline bath for more than an hour. Up forward, the pilot smoked off and on and I sat there with my knees shaking and my mouth dry—a human torch waiting to be ignited. The gasoline deloused me, though!

When I staggered off the plane at Nairobi the RAF officer who was there to meet me took one look and gulped: "That song'll have to be changed. 'Mad dogs and Englishmen go out in the midday sun . . . but Americans go out oftener!'"

There were some *Mohawks* there which were needed urgently. I didn't shave. I didn't bother to eat. I borrowed a suit of coveralls. I went to work. The operation was successful. Those *Hawks* went up two nights later and whipped hell out of a flock of German planes! END

Reverse Thrust

(*Continued from page* 43)

The primary purpose of reverse thrust (it also is known as reverse pitch, negative pitch and dynamic braking) is to reduce a plane's landing run distance, and tests conducted for the Air Technical Service Command under the supervision of Curtiss engineers have proved that it performs that function extremely well. In fact, many of the new four-engined airplanes are being engineered to include it.

In addition to satisfactory performance, Engineers Sheets and MacKinney report, reverse thrust permits a reduction in design weights of wheels and brakes, reduces maintenance and wear of tires and brakes, aids in taxiing and parking, and provides an important safety factor when wheel brakes are ineffective because of wet or icy runways or mechanical failure.

Average landing run measurements obtained during 50 flight tests with a four-engined military plane were as follows, the engineers report:

Using brakes alone, 2,700 feet; two propellers reversed, no brakes, 2,050 feet; four propellers reversed, no brakes, 1,430 feet; two propellers reversed, with brakes, 1,400 feet; four propellers reversed, with brakes, 1,190 feet; emergency locked brakes, 1,300 feet.

The engineers pointed out that the short landing run with locked brakes cannot be considered a normal landing since the tires and tubes for both outboard wheels were worn completely through and the tread of the inboard tires was damaged to such an extent that they had to be replaced also. These tests showed that with four propellers reversed and no brakes, the landing run is 53 per cent of that with brakes only. When brakes were used with four propellers reversed, a landing distance only 44 per cent of that with brakes alone results.

To determine the effect of unequal thrust, one outboard propeller was reversed in a taxi run at a speed of 85 m.p.h. Even under that severe condition a straight course was held by the use of brake manipulation for steering.

During Curtiss tests of a plane equipped with tricycle landing gear it was noted that there was a tendency to pitch forward onto the nose wheel at the time reverse thrust was applied. But that happened only on landings made with the tail down in order to obtain the greatest possible drag effect from the wing. The forward pitching is believed due to a combination of reduction in tail effectiveness and sudden loss of wing lift. However, with a nose-down landing, no tendency to pitch forward was observed on a tricycle gear.

After many tests during which the propellers were reversed after contact with the ground was made, the engineers decided to check the possibilities of reversing during the period between actual landing and the final approach. A test landing was made where inboard propellers were reversed while the plane was approximately 10 feet from the ground. Lift was immediately lost, resulting in a rather hard impact landing. This procedure could, it is believed, be used for emergencies but it is not recommended as a normal practice for safety and passenger comfort reasons.

Engineers Sheets and MacKinney also report that the use of reverse thrust during landing is advantageous for twin-engined airplanes. Test data accumulated on a *Mitchell* and a *Marauder* indicate that reverse thrust from propellers only (no wheel brakes) is approximately 95 to 105 per cent as effective as normal wheel braking and that the use of reverse thrust to supplement wheel brakes reduces the ground run to approximately 75 to 80 per cent of that obtained with normal brakes alone.

The use of reverse thrust as a means of braking on the ground will bring about considerable savings in the design weight of airplane brake systems. The Curtiss engineers report that the potential weight saving in a plane with a gross weight of 50,000 pounds and a standard braking system weighing 400 pounds would be 200 pounds. On an airplane having a 100,000-pound gross and an 800-pound brake system, the weight saving would be 400 pounds. These weight savings are believed to be obtainable since satisfactory normal landings can be made with reverse thrust alone or, if desired, with reverse thrust supplemented by wheel braking after the airplane has decelerated to about 40 m.p.h. In such instances the amount of work done by the brakes would at most be only about 20 per cent of that required for landings in which brakes alone were used.

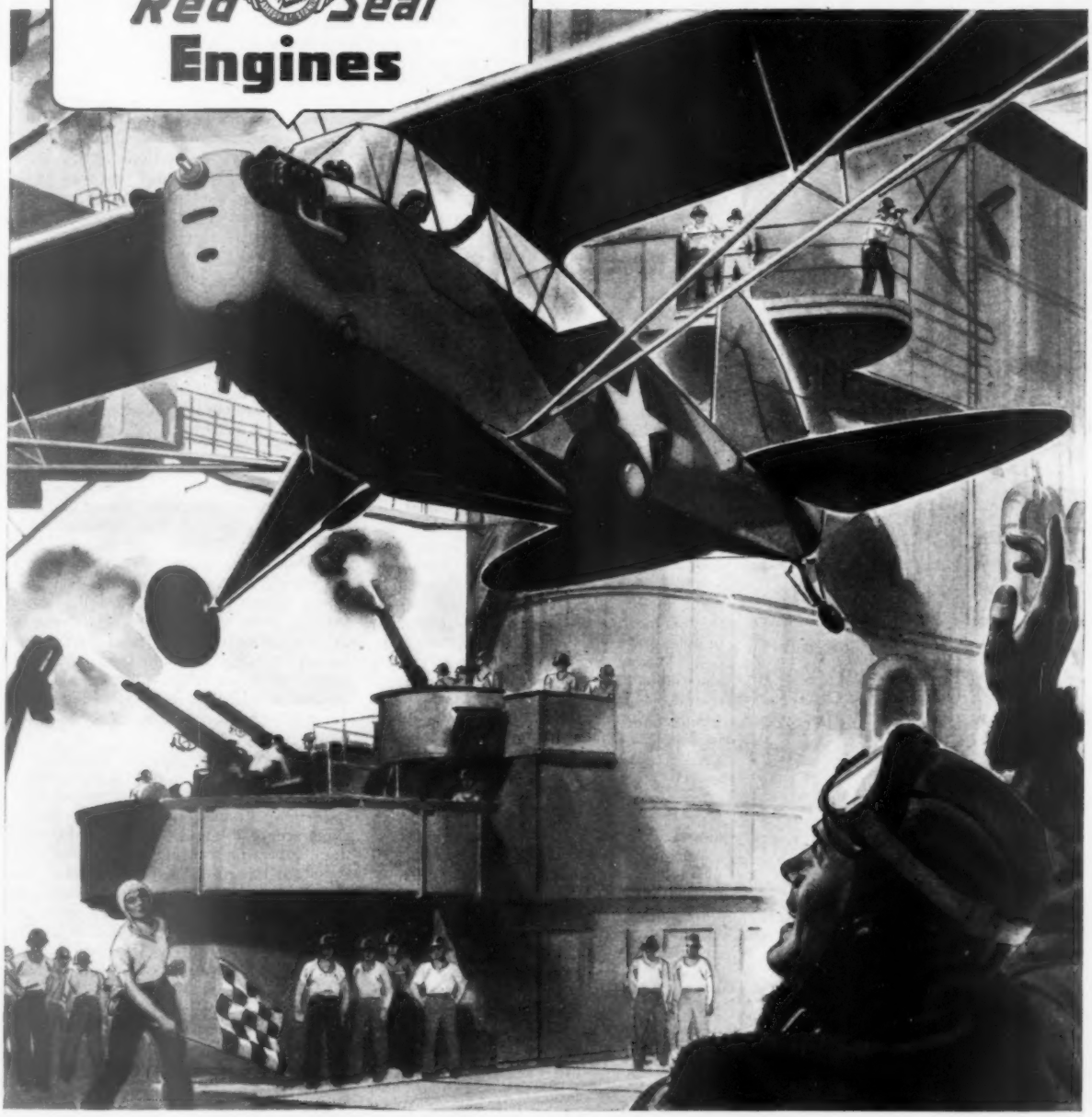
In addition to its value in reducing the landing run distance and brake weights, reverse propeller thrust braking is valuable as a safety precaution. The safety factor in making a successful landing with a defective mechanical braking system is greatly increased with only a small weight increase in the propeller

SUNK MARINER

THIS shows what punishment the hull of a Navy flying boat will take. Fire in the starboard engine of this Martin *Mariner* during a test hop, necessitated a mid-ocean emergency landing. The big plane hit the water with terrific force. On the first bounce the starboard engine broke loose from its mount and dropped into the sea. On the second bounce the port engine tore loose. Fearing the wing tank would explode, the crew abandoned ship, but the big plane drifted for 1 hr. 26 min. in the heavy seas before the pounding broke the right float from the wing.

Loss of this support caused the big plane to slide over on its wing, letting seawater pour in an open waist hatch. Half an hour later it sank. All of the crew was saved by a fishing schooner.

Continental Red Seal Engines



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equipment to provide reverse thrust. Landings can be made by the use of reverse thrust, utilizing runway distance equal to or less than that required with a good mechanical braking system. The effectiveness of propeller braking is not diminished by the condition of the runway surface. The importance of safety to operating personnel and passengers, as well as the advantages of scheduled operation in unfavorable weather conditions, cannot be over-emphasized.

A minimum of additional equipment is required with the conventional electric propeller to provide reverse pitch operation. It is necessary to add only a control relay and a reverse-normal switch to the propeller circuit, although it is customary to install an additional reverse pitch safety switch to make two separate operations necessary for reversing. The two-operation setup eliminates the possibility of inadvertently reversing the propellers.

The reverse-normal switch acting with the reverse pitch relay disconnects the normal propeller circuit and energizes the reverse pitch lead to the propeller. When returning from reverse the control relay stops the pitch change at the low pitch blade angle and restores the normal propeller circuit. The direction of propeller rotation is not changed to provide reverse thrust; the blades are merely rotated to a negative angle and propeller rotation continues uninterrupted.

The weight of the additional mechanism necessary for reverse thrust operation as perfected by Curtiss is approximately one to two per cent of each propeller's weight when two propellers are reversible. For four propellers to reverse simultaneously, additional equipment weighing about one and one-half to three per cent of each propeller's weight is required. Since only one relay, a reverse switch, a reverse safety switch and some wiring are required, cost is low. It has been estimated this cost is about one per cent of the cost of the propeller.

Accidental or inadvertent reversing of propellers at altitude could have serious consequences, due primarily to drag of the propeller and loss of lift of the wing in that area, but such an occurrence is unlikely. So far as the Curtiss electric propeller is concerned, there is no manner in which the propeller can go into reverse when it should be operating under a constant speed or fixed pitch condition. A two-operation reversing procedure is a safeguard against reversing in the air. It also is possible to provide additional safeguards, such as air-speed sensitive switches, switches working in conjunction with the landing gear, etc.

In summing up their findings, the two Curtiss engineers said, in part:

"Some military aircraft must land at airspeeds fairly close to the stalling speed, resulting in rather high sinking speeds, in order to stop by the use of brakes in a limited distance. It would therefore appear advantageous to use reverse thrust for added braking effect, permitting higher landing speeds without increasing the landing roll distance. This will result in greater controllability of the aircraft while airborne and will aid in the recovery of flying speed if, for any reason, the planned landing cannot be made.

"Present aircraft, such as the DC-3, can be quite readily maneuvered by means of locking one brake or the other, gunning the engines and swinging the tail around. However, as aircraft with larger and larger fuselages and wing spans come into operation, it is believed that the advantages of being able to maneuver aircraft more readily, such as backing into loading ramps, will be of considerable value. Reverse thrust from propellers will assist in parking as well as in taxiing where possible. Reductions in the use of wheel brakes also should be of value."

Underlying the success of reverse thrust on twin-engined and four-engined land planes is the experience accumulated by pilots of flying boats equipped with reversible propellers. Their use on flying boats was perfected in 1940 during tests supervised by the U. S. Navy Bureau of Aeronautics, and the reversing mechanism has been installed on many such craft in the past two years. It is invaluable in water handling of flying boats because conventional propellers offer little or no control during low speed taxiing. Without reversible propellers the only source of directional control available is provided through a variation in the forward propeller thrust between the various engines. That is not satisfactory when the flying boat encounters a combination of wind and adverse water currents. Adding controllable negative thrust to the normal forward thrust enables a pilot to turn in a small radius, to stop or to back in almost any combination of wind and current. Including relays and switches, the increase in weight is less than four pounds per reversible propeller on a flying boat—a negligible weight.

Whether reverse thrust would be of practical value on small, single-engined lightplanes is problematical. Since landing runs of such aircraft are normally short, reversible propellers would be of doubtful value except, perhaps, on those craft not having wheelbrakes. But even on a light airplane without wheelbrakes the increased cost of a variable pitch propeller which could be operated in reverse probably would not be justified. Unless the propeller required for normal forward pitch could be adapted to reversing with little or no increase in weight, cost and complexity and with no lessening of reliability, it is felt that reverse would be of little practical help in the lightplane field.

The history of reverse thrust propellers is a curious one. Experiments to prove the feasibility of using the propeller as a brake on the ground and in the air have been carried on sporadically since 1917 in the United States, but despite the apparent success of some of the tests and the steady accumulation of test data the device was not perfected to the point where it met widespread acceptance until quite recently. The use of reverse thrust as a diving brake for military planes is now being developed in this country and in Europe.

The engineering division of the Army Air Service made tests before 1920, using a DH-4 biplane with a reversible pro-

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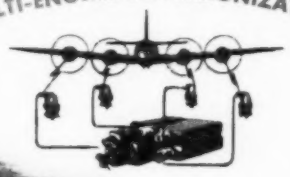

UNIT INTERCHANGEABILITY

AERODYNAMIC BRAKING

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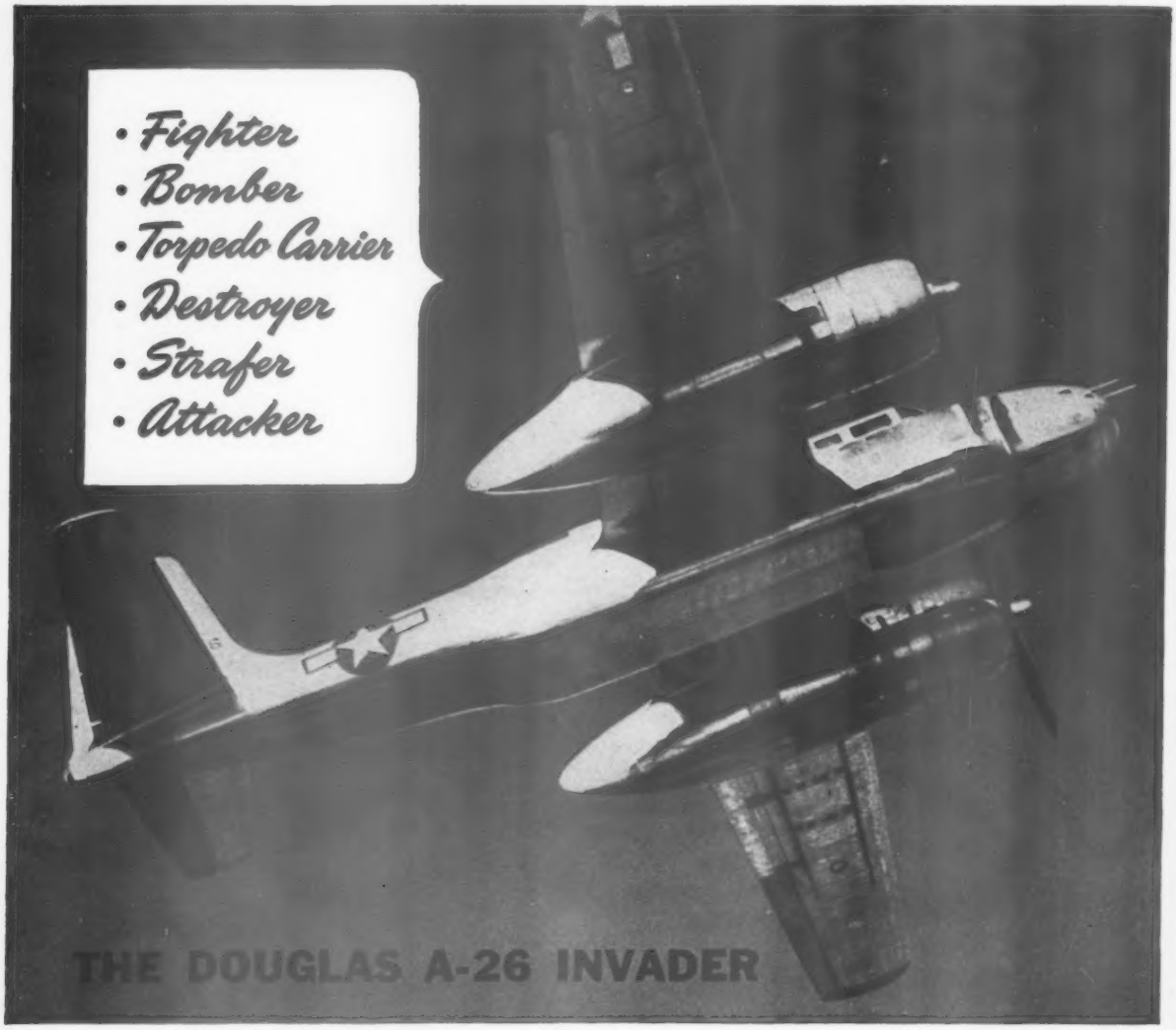

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peller designed for land braking. The blades of the propeller were turned in ferrules which formed part of the hub, with the operating mechanism housed in the hub and the ferrules. A published report of those tests pointed out that "it was necessary to reduce the speed of the propeller while it was passing through the neutral pitch position (toward the negative blade setting) in order to prevent the engine from 'racing.'" Engine "racing," caused by propeller windmilling, was a problem for several years in the field of reverse research. It was finally overcome by providing almost instantaneous reversing.

Tests of a controllable, reversible variable pitch propeller for landing run braking were completed by the Airplane Appliance Company of Los Angeles in 1929. The airplane used was a Fokker *Super-Universal* and test flights were made by Lieut. Grission Haynes, Ray Howard and Cliff Schwartz of the Fokker company and Col. Arthur Goebel. Colonel Goebel on one occasion landed on a field at 100 m.p.h. and stopped the plane at the end of a 40-foot run with the propeller blades reversed. With the plane coming in at a steep gliding angle, the propeller was put in reverse with just enough engine speed to kill the tail group.

Much of the early experimentation with reversible propellers was directed toward their use as diving brakes. The NACA, the Bureau of Aeronautics, the Navy Department and the Army Air Corps in 1930 calculated the terminal velocity of a diving airplane with propeller in the reverse position. While the terminal velocity decreased with the blade angle setting, it was decided that a further decrease in pitch would lower the limiting velocity still further. The airplane used was a Navy F6C-4 equipped with a Pratt & Whitney R-1340-CD engine and a Hamilton Standard propeller of the controllable pitch type. The propeller was allowed to windmill against engine friction. The pitch-changing mechanism consisted of a hydraulic piston and centrifugal weights, which actuated the blades through a system of push-pull rods.

A European viewpoint of the significance of reverse thrust is contained in an article in the August, 1944, issue of Aircraft Engineering, a British magazine, discussing the Escher Wyss automatic variable pitch propeller:

"The landing brake operation of aircrews provides, at first, the possibility of shortening the landing run of a given aeroplane. Since the take-off distance becomes the most important factor in determining dimensions of the aerodrome necessary for an aeroplane provided with the possibility of airscrew braking, the aeroplane can be constructed in accordance with this new possibility so that it will land in approximately the same distance at a considerably greater speed. Consequently, it becomes possible so to increase the wing loading that, with the means now available, the maximum speed may be increased to a figure never before reached." END

Spherographical Navigation

(*Continued from page* 65)

bered every 5′ of arc. Each division represents 1′ of arc, as determined by the pitch of a precision ground lead screw. The latitude or declination setting as shown in Figure 2 is 37° 15′ S. The accuracy of these settings is plus or minus 5′ of arc or better. To draw a latitude of declination circle upon the sphere, the navigator need only rotate the pencil thimble until the spring-acuated pencil drops upon the surface of the sphere, then swing the meridian hoop. The pencil is metallic so that a fine line will be produced without excessive flattening of the point by wear or abrasion. A pencil sharpener is provided to recondition the point of the pencil.

The edge of the meridian hoop is ground so that when it is desired to construct a meridian circle or vertical circle, the navigator employs this edge of the meridian hoop as a guide for his pencil as he draws upon the surface of the sphere.

The spherical compass consists of a circular segment bar. Its center of radius is at the theoretical center of the sphere. The periphery of the bar is precision notched in 1° intervals the same as the meridian hoop (see Figure 3). On the bar is mounted a micrometer slide whose construction and manipulations are the same as that of the micrometer on the meridian hoop. Mounted on the micrometer slide is the index pin which is the pivot point of the compass when drawing a circle of position. Fixed at one end of the bar are two legs which, in

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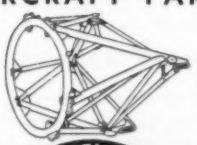

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conjunction with the index pin just mentioned, serve to keep the bar at the proper distance from the surface of the sphere and maintain the pencil in a perpendicular position. Combined with the legs is the pencil housing containing the slideable metal pencil as on the meridian hoop. To draw a line the pencil thimble is ro-

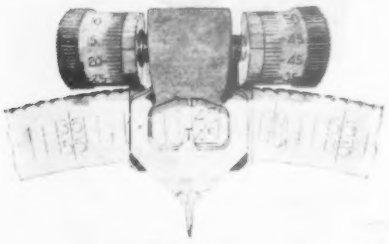

Figure 3.

tated slightly and the pencil drops down upon the surface of the globe. Spring actuation assures uniform pencil pressure.

It will be noted that there are two scales on the bar. The orange scale marked "Altitude" is the scale which the observed, corrected altitude is set upon when drawing a circle of position or line of position. Actually the arc subtended is the co-altitude. Figure 3 shows the compass set to draw a circle of position of a star whose observed corrected altitude is 46° 17′. The second or white scale is the actual angle which is subtended as measured along the equator. When employing this scale, the white minute thimble should be used. Figure 4 shows the

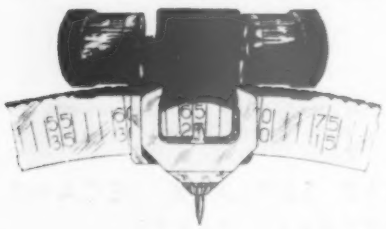

Figure 4.

compass set to mark off 65° 31′ on a great circle.

To draw a great circle course and measure great circle distances in nautical miles, the great circle ruler is used. It is designed so that it will rest upon the surface of the sphere and its divided edge will represent any great circle. A great circle may be drawn by using this edge as a guide for the pencil.

Great circle distances may be measured by setting the edge of the great circle ruler through the two points which the distance separates and setting the "0" mark at one of the points. Each division represents 20 nautical miles and the figures represent hundreds of nautical miles. The great circle ruler is shown in figure 5 in position to measure 1,540 nautical miles. As an average, with a slight amount of practice, these distances can be measured to within three nautical miles.

The spherical protractor is similar to an ordinary plane protractor, except that it is spherical in contour so that its inside edge fits the surface of the sphere. Around

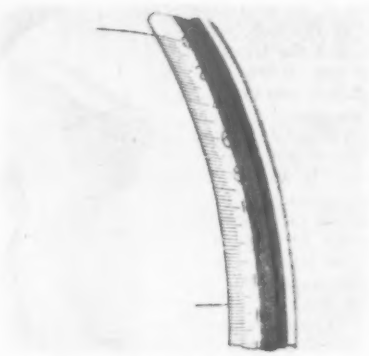

Figure 5.

its periphery is a scale divided in 1° intervals and numbered every 10° of arc. When measuring azimuth, the straight edge is set along a meridian circle, with the long orange line of the straight edge

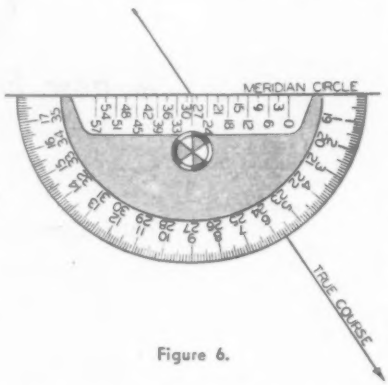

Figure 6.

at the origin of the axis. Figure 6 shows a true course heading of 57°. When the straight edge is to the west, read the white scale which is marked from 0° to 180°. When the straight edge is to the east use the orange scale which is marked from 180° to 360°.

The scale along the straight edge of the spherical protractor is a vernier scale for the equator of the sphere. This allows an equatorial angle to be directly read to 3′ of arc and readily estimated to 1′ of arc. Place the zero mark of the protractor, with the straight edge of the protractor along the equator, on the meridian circle in question and read the vernier division

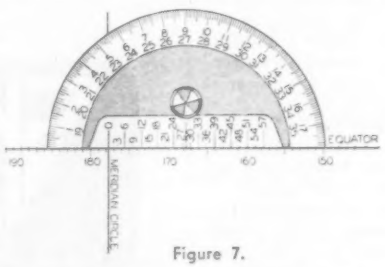

Figure 7.

which registers with the equator division, giving minutes of arc. Figure 7 shows a vertical circle which has a sidereal hour angle (SHA) of 177° 39′.

On the surface of the sphere, .002 inches is approximately equal to one nautical mile. At once, the practicability of such a small scale is questioned. As the accuracy of the instrument theoretically allows the solution of problems accurate to within 500 feet, the main error may be attributed to the human element. These may be items such as altitude reading, which, if accurate to 3 of arc, is considered excellent, and variations of plotting by the navigator. These are errors which cannot be eliminated but do, however, tend to average.

With practice and a good scale, any person can scale a distance to an accuracy of less than .005 in. Toolmakers, machinists, and draftsmen do this daily. Others may doubt that the naked eye will detect .002 in. or smaller. Human hair ranges from .002 to .004 in. in diameter. If one lays one hair across another on a white background, both may be seen with ease. Spider webs are composed of threads of .0001 to .0005 in. in diameter. Yet they may be readily seen if the proper background is provided. Reasonable care in laying out, measuring, and drawing upon the sphere must be exercised. To produce a good job, the metallic pencils must be kept sharp, much the same as a carpenter or machinist must keep his tools sharp to produce a good job—or the same as a navigator keeps the lenses and filters of his sextant or octant clean and checks on the accuracy of his sextant or octant and watch.

An example of the use of the Spherographical System in navigation is the problem of obtaining a two-star fix.

We shall let H_o represent star altitude after the corrections for index error, refraction, parallax, etc., have been applied. In a problem of this type it is not necessary to assume one's position before starting. Following are the data required to determine a fix from two stars (refer to Figure 8):

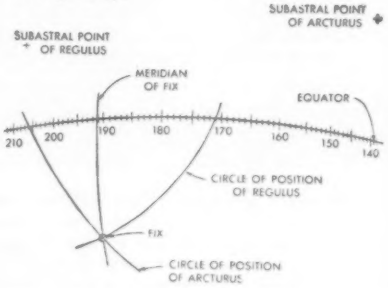

Figure 8.

Date: 4/13/43
Time: 0100 GCT
1st star: Arcturus
SHA 146° 44′ } From Air Almanac
Dec. N 19° 29′ }
H_o 28° 51′
2nd star: Regulus
SHA 208° 40′ } From Air Almanac
Dec. N 12° 15 }
H_o 50° 21′
GHA ♈ = 215° 21′—From Air Almanac

As the 22 major navigational stars are permanently plotted upon the surface of the sphere, the SHA and declination of the stars in this problem are given for reference only. From year to year the corre-

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lations between these stars does not vary enough to affect the accuracy of navigation problems materially. Their positions, as spotted on the sphere, are good for several years.

To plot the above problem, we orient the globe to a convenient working position so that the sub-astral points of Arcturus and Regulus are on top. Set the spherical compass on the altitude or orange scale to read 28° 51 which is the H_o of Arcturus. Insert the index pin into the sub-astral point of Arcturus on the sphere and draw a segment of the circle of position of Arcturus which passes well across the approximate azimuth line of the star observation. Next, set the spherical compass to 50° 21 on the orange or altitude scale which is the H_o of Regulus. Insert the index pin of the compass into the sub-astral point of Regulus and draw a segment of the circle of position of Regulus which passes well across the approximate azimuth line of the star observation and through the circle of position of Arcturus. The intersection of these two circles of position is our fix. Actually, the two circles of position will intersect at two points several hundred miles apart. The intersection which is our fix can be determined simply from noting the approximate azimuth of the star observations. To determine our latitude we set the micrometer slide of the meridian hoop *to the degree division closest to our fix and between the fix and the equator*, which in this case is 23° S. Next drop the pencil down and rotate the orange thimble, because we are in the southern hemisphere, until the point of the pencil is on the fix. The micrometer should now read 33'. The latitude is then 23° 33' S.

The longitude of our fix is determined by the addition of SHA of our fix and GHA ♈. We must, therefore, construct a meridian circle with the meridian hoop through our fix and extend it to the equator in order to determine accurately the SHA of our fix. By means of the equatorial scale on the sphere in conjunction with the vernier scale on the straight edge of the protractor, we find the SHA of our fix to be 191° 18'. We next add the SHA of the fix to GHA ♈ for the time of observation, which we read from the Air Almanac

SHA fix = 191° 18'
GHA ♈ = 215° 21' From Air Almanac
406° 39'

As this sum is greater than 360° we must deduct 360°. This gives 46° 39' which is our longitude. However, to determine safely whether east or west, the navigator should construct the usual time-longitude diagram. This calculation clearly indicates that our longitude is 46° 39' W.

The Spherograph can likewise be used to work out a three-star fix; to solve an advanced line of position problem; to determine a radio fix; to work out a preplotted flight, and for numerous other navigational purposes. It is best mounted on special rubber shock mountings. The sphere may be inserted in the navigator's desk or on bulkheads. The accessory instruments are held in recessed pockets to avoid damage.

The manufacturers believe that long-range air transport calls for instruments free of delicate mechanisms needing constant checking, and they claim that the rugged design of the Spherograph will hardly permit it to become maladjusted in any normal flying conditions. END

Arctic Air Watch

(*Continued from page* 23)

demic of "cabin fever." That's the reason why the man-and-wife-team idea was attempted.

At first, CAA drafted men with families. But children, they found, created other problems. One parent had to be with the children and that meant that husband and wife worked on different shifts. It wasn't long before both were short on sleep. In isolated regions schooling had to be done through correspondence courses.

Changed draft rules, plus the discovery that childless couples apparently had a better chance for success at their jobs, caused a third shift in CAA's personnel policy. This time they wanted 4F's with wives and no children. Recruiting them, however, proved difficult. It was a United Press news story that turned the trick. It promised "An extended honeymoon . . . just like the Alps for winter sports . . . a paradise for camera enthusiasts . . . hunting, fishing—50-inch rainbow trout . . . caribou, bears, grouse, ducks . . . gardens that yield bigger and better vegetables." The story provoked as many inquiries as a fizz tablet does bubbles. More than 16,000 letters poured into the Washington and Seattle offices. Enlistments were made, aptitude tests given and six-month training courses got under way.

Within seven months the first of the new recruits—artists, musicians, office workers—were Alaska-bound. For a few the Alaskan assignment meant boredom and loneliness. But the majority—couples like Tex and Anne Noey—will tell you that theirs is a full, good life.

The Noeys couldn't have dreamed a few years back of an isolated outpost at Kotzebue, Alaska, as a setting for marital contentment. Tex was a construction worker and Anne a nurse in an Anchorage hospital when they met. Now the Noey's are CAA aircraft communicators. They typify this little army of man-and-wife teams recruited by CAA to gather and disseminate weather information to pilots on Alaskan Airways. Their station forms a link in the chain of ground facilities built for safe aircraft operation along air routes in Alaska and on north of the Arctic circle.

Overtime pay, plus an extra allowance for Alaska's high living expenses, brings their base pay of $2,000 each to a joint total of $5,960. They pay $25 a month for the furnished five-room cottage which the CAA provides for each of the families on its staff. Because of difficulties in transportation, it sometimes costs the CAA $25,000 to place one of these houses at remote stations like Kotzebue. They are especially designed for Arctic weather, and are actually among the best houses in Alaska. They are oil-heated, have streamlined kitchens with fluorescent lighting, and are comfortably furnished. Four or five cottages like the Noey's and two-score private dwellings of an earlier vintage comprise Kotzebue.

Tex and Anne Noey keep a six months' supply of canned goods on hand and when they need fresh meat, they go out and

UNUSUAL FIGHTER

ONE of the most unconventional fighters to be tested by the Army Air Forces in recent years was this experimental monoplane, the Consolidated Vultee XP-54. This design is understood to have been discarded in favor of fighters now in, or going into, production.

The XP-54 was powered with an experimental Lycoming engine, driving a four-bladed pusher propeller. The pilot had unusual visibility, sitting well forward of the inverted gull wing. The fuselage had an extremely long nose, which housed what appears to have been four cannon. Other structural features were twin tail booms, pressurized cockpit, and a device for ejecting the pilot in an emergency.

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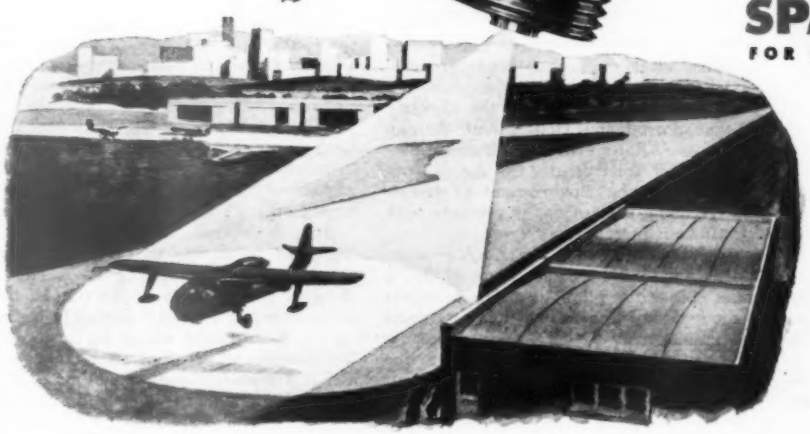

C34S—Shielded

shoot it. In the fall, an Eskimo herder comes through with the reindeer herds, adding to their supply. When the Noey's pick out and pay for the one they want, the herdsman shoots it on the spot. Tex skins and quarters it and stores what they don't need in a community food locker—a big room of permanently frozen earth carved out of a nearby hill. They can replenish their larder through the CAA commissary in Anchorage if they run short, but delivery must be by boat or airplane. At irregular intervals they get fresh vegetables—a luxury in Alaska. Every time a CAA plane makes the trip to Kotzebue, its pilot has orders from CAA's eighth region manager, Marshall Hoppin, to take along a supply.

Tex and Anne each work an eight-hour shift. The daily stint, they say, never drags—even weather reports can be dramatic. Bad weather means delayed planes—sometimes means a houseful of overnight guests if a plane is grounded at Kotzebue. Anne has entertained as many as 12 unexpected overnight guests.

Through their radio, Tex and Anne keep in touch with what goes on all over Alaska. When they learn that the CAA plane is making a trip to Seattle they add their commission to the long list of errands pilots accumulate as soon as word gets around of intended flight. An errand list reads something like this: 20 rolls of film, size 620; one house dress, size 14, flowered; an egg beater; a carpet sweeper; get my wolf-skin rug; call MAin 2245 and ask Mrs. Johnson why she doesn't write. Hoppin always adds an order for 500 pounds of fresh vegetables. (Lettuce, for example, at 10 cents a head in Seattle, costs 40 cents a head in Anchorage and $1.10 a head in Nome. It is simply unobtainable in the small settlements.) The Noeys, like other families in remote stations, are preferred customers when the vegetables are distributed.

Supplies for the staff at Nome, where the harbor is frozen six months of the year, are generally brought in by the "CAA Airline." The boys in the hangar refer to it as the "Happy Action Faction Traction." It consists of Douglas DC-3, a Boeing 247D, a Douglas *Dolphin* twin-engined amphibian, a six-place Bellanca, a four-place Fairchild and two new eight-place, twin-engined Beechcrafts.

Both of the larger planes have paid for themselves many times over. Like most planes in Alaska, they are second-hand. The Boeing 247D (NC-18) was bought by the CAA in September, 1942, for $40,000. Originally it had belonged to United Air Lines; they sold it to Pennsylvania-Central Airlines, which in turn sold it to the Celanese Corporation, which then sold it to the CAA.

The Douglas, facetiously called the DC-3½BD (Big Door), was purchased in May, 1943. It had been a CAA patrol plane and was used on general inspection and air carrier duty, and then was assigned to the Houston Standardization Center. There, in anticipation of its Alaskan duties, it was given the structural changes and the big door which account for its special tag.

Within the last two weeks of April the DC-3 delivered 16 transmitters to CAA outposts; each weighed 6,400 pounds. A special winch and a demountable A-frame hoist make it possible for the pilot and co-pilot who make up the two-man crew to load or unload any cargo without assistance. Both planes usually travel with the seats out. Passengers and freight are piled in so as to get maximum use of each trip. Passengers get interesting "fundamental impressions" of travel in Alaska from sitting on the edges of packing cases and tractor treads.

The CAA's seven-plane "airline" is run on an on-call basis, and CAA personnel like Tex and Anne are not the only ones served. Vital emergency loads are carried for other U. S. agencies in Alaska—the Fire Control Division of the Forestry Service, Post Office Department, Bureau of Indian Affairs, Weather Bureau, Department of Agriculture, the Army, contractors building Government projects—always being careful not to compete with existing airlines.

LIGHTNING FLAP

DIVE flaps now built into the Lockheed *Lightning* permit absolute control over the aircraft during the tremendous speeds of a vertical dive. Previously, the *Lightning* had difficulty recovering from a dive once high speeds were attained. The Army and NACA at first were prone to blame the distinctive tail design of the *Lightning*. Subsequent tests by Lockheed engineers and test pilots proved, however, that the speed of the plane entered the "area of compressibility" in dives. A new set of aerodynamic laws was evolved, showing that at certain speeds the known computations for air flows are reversed.

The small dive flaps are not diving brakes but merely control compressibility flow. They are operated electrically by a small button on the control wheel and are supplemented by hydraulic boosters for the ailerons. Each device complements the other and permits maneuverability and control at extremely high speeds.

An average week for CAA's pilots means approximately 30 hours of flying time. Since the pilots also help schedule the trips, load and unload the cargo and make emergency repairs, they work on a fairly rugged schedule. According to one pilot "Winter is when we really earn our money. Unloading out on a windy, cold field, the engines cool off and may take hours to start. Often we have to break out the fire pots to warm them up. The hydraulic fluid leaks and tires freeze to the ground."

A list of the plane's required emergency equipment gives a pretty clear picture of the hazards of Alaskan flying. All planes must carry rations sufficient for 10 days for all passengers. They must have radio equipment, rubber rafts, sleeping bags, snow shoes, an automatic SOS transmitter, fire pots and hoods to heat the engines and a device to heat the oil which has to be removed each night, reheated and replaced.

But it's the ground personnel that comprises the most important part of the Alaskan pilot's safety equipment. Prior to 1939, Alaskan "airways" comprised shelter cabins erected by the Territory at intervals of 30 to 40 miles along the main trails. Built many years ago, the cabins eventually were equipped with radio. In 1937 they were taken over by the Alaskan Aeronautics and Communications Commission. That combination makes good sense in a region which, as a Negro cook employed on the Alcan Highway complained, "Ain't nothin' but miles and miles of miles and miles." The network of aviation radio now covers every part of it.

As isolated as it is important is the weather station on North Dutch Island manned by the Grimsteads, another successful CAA team. They have a climate like that of New England, lovely surroundings, gorgeous scenery. But Phyllis and Edwin Grimstead and their pet Peke, "Butch," are the only inhabitants of North Dutch Island. All their supplies and mail are brought in by an Army boat which stops there every other week. They have been there nearly a year and haven't yet begun to think "What next?"

North Dutch Island is situated at the narrow end of Prince William Sound on the airway between Anchorage and Cordova. Cold air from the Alaskan mountains meets the warm Japanese current there, causing frequent and severe atmospheric pressure changes with resultant unsettled weather conditions. The Grimsteads thus have an important post—and they fill it expertly. Phyllis, an accomplished pianist, explains that her knowledge of rhythm and time helped her learn telegraphy.

Despite this isolation all Alaska is like a small town, for everyone knows a good deal about what his neighbors—even those hundreds of miles away—are doing. For more details on the doings of CAA personnel, Tex and Anne rely on the Mukluk Telegraph. Its staff—complete with printer's devil, night editor and even censors—manages to get the eight-page paper out every month. It is delivered by "Manager and Newsboy" Jack Jefford.

Among the new assignments noted in the June issue was that of Norman and Romayne Potosky to the CAA staff at Nome. They are having the time of their lives living in a land completely strange to the department stores of Boston and Washington where they once did personnel and research work. Neither of them had ever been West before and when they

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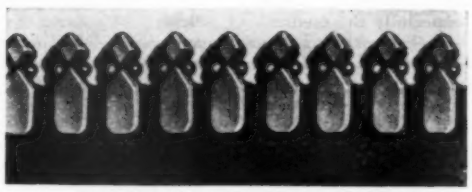

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reached their first assignment at Aniak, Alaska, their associates dubbed them "cream puff pioneers." But when Norman shot the 180-pound wolf that "used to help Romayne take weather observations," the Potoskys were vindicated. If they choose to tote guns now, it's generally conceded that they don't do it to show off.

Other diversions are more social. Soon after the Potoskys arrived at Nome it was decided that the time had come for a CAA party. So they divested the utility house of its customary washing, decorated it in what they call "Nome baroque" and issued invitations for a "beera brawla." The dance was so successful that it has been voted a regular biweekly affair.

These are the people who are making aviation and radio the biggest things in Alaska. Of course, radio was used in Alaska as early as 1910 and planes were widely used by the early 1920's. But now there are over 800 radio stations there. Emergencies which once were met by radioing for help to the *Meteor*, a little commercial steamer that visited the coastal communities about once a month, are now handled in a matter of hours. Saving in travel time between Nome and Fairbanks—now that one can go by air rather than dog sled—is about three weeks. Instead of costing a minimum of $1,500, the four and one-half hour trip now costs about $72. The important thing is that the whole business is becoming increasingly safe—thanks to the Alaskan man-wife teams. END

Farewell to Superman

(*Continued from page* 34)

hall farms out projects to the National Research Council and two of their more recent and least-publicized jobs have concerned the physical testing of pilots. Among other things, one project matched up the direction which an instructor told a student to look during landings with movies of where the instructor actually looked himself and how he used his eyes. Other findings of this study of eye movement in a cockpit were so revealing that they have been put on the top secret list until after the war.

Another NRC project is getting under way at two big university centers which had not been announced as we went to press, but probably will be in California and Ohio. Some 200 persons with poor visual acuity will be taught to fly, in order to make honest judgments on the standards of vision that should be written into the regulations. Should the new medical regulations get bogged down, these studies are expected to get them back in the running. Results are expected to be ready early next fall.

It should not be assumed from this that those favoring heavy old-style regulations have taken the Brimhall findings and the Warner-Lankford drive to streamline regulations—especially the medical—without protest. The opposition, spearheaded by Dr. W. R. Stovall, chief of the CAA Medical Division, and his assistant, Dr. A. J. Herbolsheimer, has taken the stand that it would be better to err on the side of safety than to let the majority of the public fly regardless of physical handicaps. Dr. Stovall also dissents on almost all other points made so far in this article.

"You are to be complimented," he told this writer, "for having assembled the most complete collection of misguided and misconceived ideas on the subject that I have been privileged to read."

Dr. Stovall also objected to the word "superman" in the title of this article.

"The title itself," he said, "is outmoded. The term 'superman' exists only in the minds of those who would use it as a weapon against physical standards for flying. A more appropriate slogan would be a paraphrase of the Scriptures, 'Man take up thy bed and fly'."

"The disqualification rate for private pilots," Dr. Stovall pointed out, "even under the most rigid conditions, was only approximately four per cent of those who applied; for more than two years past it has been but 1.5 per cent; and more recently only 0.8 per cent. Of these disqualifications, 98 per cent were sustained by the CAB when the applicants chose to come to a public hearing of his case. In contrast, consider the number rejected for military service, even the 'limited service' category, or the incidence of any one of the major debilitating diseases."

"Your article," he continued, "is productive of controversy between the Civil Aeronautics Board, who makes the regulations and sets the standards, and the Administrator, who must do the dirty work of enforcement. Such ill-will makes none the less easier our already difficult task of obtaining compliance with standards and regulations that we are not responsible for.

"You have defined the functions of the Board and Administrator, yet have made the common mistake of assuming that the medical examiner makes the determination as to whether an applicant flies or not. The medical examiner merely reports the medical facts as he sees them. If the applicant meets requirements, his ability to pilot aircraft safely is presumed; if he does not, authority other than the medical examiner decides as to whether he shall be given an airman certificate. "Unfortunately, both decisions have been embodied in the one medical certificate until recently, thus giving credence to the popular belief that the determination is made solely by the medical examiner."

"We join the optimists in hoping for an early settlement of physical standards," Dr. Stovall said to this writer.

Commenting on Mr. Warner's statement that "medical requirements were perhaps one of the most flagrant offenders," Dr. Stovall expressed the hope "that Mr. Warner in his position feels qualified to make such a statement. He has overlooked at least one important source of information in preparing himself for this opinion—the medical division. We wonder if the position he has taken is not the result of some unfortunate experience."

He pointed out that "the present time interval for physical reexamination is based principally on the results of a joint survey conducted in 1942 by the CAB and the Administrator," adding in passing that he had recently retrieved his copy of this survey from Dr. Brimhall's office "where it seems to have been buried for more than a year.

Dr. Stovall stated: "The Administrator's medical certification policy has emphasized this conviction since 1942. His post-war medical plan, available to anyone who cares to study it since March 1943, contains all the elements necessary to make medical certification the 'least possible trouble.' Such provisions as regional medical offices, examiner coverage, proof-testing of proposed changes in standards, regional clearance of questionable cases, statistical studies of examiner performance, and analysis of medical records are provided for. We are ready to institute this plan as soon as funds are made available."

Dr. Stovall made the point that exceptional physical cases are "the only basis for disqualification."

"You may be interested to learn," he added, "that the authority with which Mr. Lankford obtained his opinion regarding proper cause for denial of medical certification lists a far greater number of physical conditions and much less severe degrees of individual defects which will cause sudden incapacity than have ever been embodied in our civil physical standards for flying."

Discussing the family physician, Dr. Stovall refers to the CAA Administrator's post-war medical plan, in which he points out "there is provision for more than three times the present examiner complement.

"Coverage seems to be the only justification for the family physician," he says, "unless there is hope on the part of the Board that they can dodge their responsibility of making final determination in medical cases by allowing the applicant to shop around through a limitless number of physicians until he can obtain a certificate from one who is either unacquainted with the standards of physical fitness required, or one who, being unaccountable for his actions, will issue the certificate with indifference as to the consequences."

In response to the statement that few changes in medical regulations had been made when the Board started its reform a year ago, Dr. Stovall said, "You have overlooked the airman certification possible and that is being issued through the latitude of interpretation of the basic standards, and under the waiver proviso." [This is a word-for-word quote.]

"Believe you me," Dr. Stovall added, "if we ever had any inclinations toward conservatism in these interpretations the pressure from above dispelled them."

(*Continued on page* 118)

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(*Continued from page* 114)

Dr. Stovall challenges the findings in the Brimhall research showing disagreement between physicians examining pilots and says of the Lankford quote in connection with the 60,000 accidents studied by CAB that "throughout this study the researchers were dealing with individuals whom the medical division had waived as having demonstrated their ability to pilot aircraft safely. If the study proves anything it tends to substantiate the good judgment of the medical division in the selection and prediction of continued ability to perform in the individuals certificated."

He also pointed out that the record card from which accident analyses are made has no place for recording the physical condition of the pilot involved in the accident and that throughout the history of Federal investigation no one trained in aviation medicine has been on the accident investigation staffs.

He said: "We believe wholeheartedly in such projects," as those now being conducted by Brimhall, "and will participate," but wants to "await the results."

"To make an exhaustive critical analysis of the proposed new medical regulations," Dr. Stovall said, "we would have to determine first acceptable definitions of adequate eyesight and all other terms."

"Again, we should inquire whether the dissatisfaction arises with the standards themselves, with the methods of their application, or with the manner in which they are administered."

Dr. Stovall sums up safety-vs.-mass-flying saying that the liberals contend "that the private flyer has a right to fly unmolested" and "kill himself if he wishes to do so—that we must expect a sacrifice of lives and property at the price of aviation advancement." In reply he says that "as we permit lowered physical standards in the student and private groups," far from turning the examinations over to general practitioners, "we must be more and more careful in our determination of those eligible for certification." In other words, the lower the standards, the more thorough the examination.

Enlarging on the case favoring CAA medical examiners, Dr. Stovall points out that "experience in other fields in which medical certification is required and in which the certificate of the family physician or any unsupervised physician is acceptable, has proven those sources to be inadequate. The reasons are to be found in the time-honored physician-patient relationship."

To this last the Warner-Lankford-Brimhall group reply that, since the Stovall method would operate, as it has in the past, with a set fee and would force an applicant to go to a specified doctor, the proposal combines the essentials of socialized medicine—putting the CAA doctors in the position of defending a system which, in other departments, they would violently oppose.

To this Dr. Stovall replies in turn that "the set fee and designated examiner system has been in use by insurance companies and other agencies, Governmental and private, for more than a century. It has not been regarded by physicians as socialized medicine, rather, it has long been accepted as a basic principle of industrial medicine, of which aviation medicine is a part—the principle that whenever standards of physical fitness are employed designated physicians who can be properly instructed and held accountable for their acts must be used for effectiveness and efficiency. A uniform fee for such services is and always has been the rule."

Dr. Stovall says that the Medical Division has consistently recommended studies toward reform but "until the past year all our recommendations for study and development of the medical standards have been treated with polite indifference.

"Evidently," he concluded, "the Board has not seen fit to acquaint the accused with the mass of damning evidence that has been submitted against us, if such exists. From other sources, however, we have been advised of comments that, I am sure, have created at least a reasonable doubt as to the conclusions drawn. If well versed in medicine, our critics should be able to recall a fact of common medical knowledge, that the individual will develop a fixation against any authority that bars him from the realization of his ambition. The triad-standards, methods, and manner of application is the logical point for fixation. To put it more simply, if you have a pain that you can't locate you rub liniment where the pain seems to be."

During the discussions which continued through 1944 and into early 1945, it was also pointed out that "exhaustive critical analysis" has been made of the problem, with results invariably favoring reform; and that, further, no studies of a qualified scientific nature had been made by Dr. Stovall and his associates. If definitions are required for the new regulations, so the argument runs, why weren't some drawn up for the old?

Even more devastating is the reply to Dr. Stovall's proposal that inquiry be made into the cause of dissatisfaction. The CAB surveys of last year show that it arose, not with the standards themselves, the method of their application, nor with the manner in which they are administered, but with all three.

Public opinion, then, was the final court of appeal in the debates, and public opinion ruled overwhelmingly for reform. On the basis of this opinion—backed up by research already completed and historic facts concerning the evolution of aviation medical examination methods—the liberals have staked their claim that the new rules will go on the books any day now.

The odds are in their favor. But, for the enlightment of Mr. and Mrs. Average Citizen, there are a few qualifying facts.

If the rules are not on the books by the time this appears and further delays are indicated, the public should make ready with protests. As has been the case since the beginning of the liberal campaign, Messrs. Warner and Lankford will welcome comment.

If, on the other hand, you see in the papers that the new rules have, with perhaps a few amendments, been accepted by the Board, don't tear up your old medical certificate after you've thrown your hat in the air and begun to cheer. Passing of the new rules may look like the millenium to many a pilot who has become enmeshed with the old ones, but Government is Government. It will take 60 days after the Board okays the reform regulations for CAA to make them effective in the field. END

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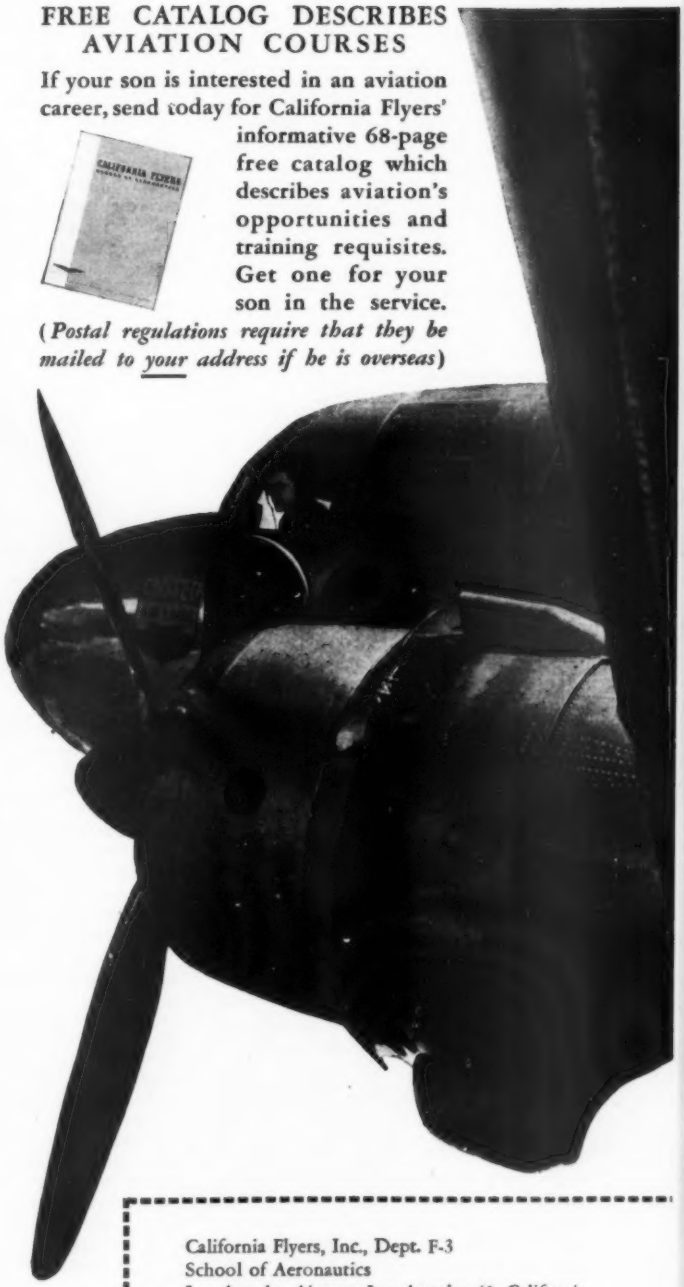

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The New Civil Air Regulations

(*Continued from page 22*)

ing six months the pilot must have flown at least six hours under real or simulated instrument flight conditions, at least three of which must have been actually flown in an airplane.

AIRCRAFT EQUIPMENT. For contact flight in the daytime, a fuel gauge, altimeter and compass are no longer required unless carrying pay passengers. Otherwise there are no changes in required equipment, except that fire extinguisher and first aid kits no longer need be carried.

LOG BOOKS. A mechanical device for recording time in flight may be substituted for engine and aircraft log books but the owner is still required to keep accurate records and the saving of time or effort would appear to be negligible. Pilot log books are not necessary except to substantiate flight time to fulfill recent experience requirements or to obtain higher certificates or ratings.

PERIODIC INSPECTION. An airplane must not be flown unless within the preceding 100 hours of flight it has been given a periodic inspection by a certificated mechanic, and within the preceding 12 months it has been given a periodic inspection by a person approved for that purpose by the Administrator.

WEATHER MINIMUMS. Some changes have been made in the minimum weather conditions for contact flight:

Ceiling. The term "minimum ceiling" has been replaced by the phrase "vertical proximity to clouds." Flight above 800 feet requires a vertical clearance of 500 feet from clouds. Below 800 feet the vertical clearance remains 500 feet in control zones but becomes "clear of clouds" for flight elsewhere. Since the minimum altitude for flight over open country has been abolished, it is theoretically possible for a pilot to fly with a ceiling as low as 100 feet if visibility is adequate.

Visibility. There are one or two minor changes in the visibility minimums. For flight above 1,000 feet the requirement is to be three miles in control zones or on airways [except when cleared by the control center or control tower], and one mile elsewhere. For flight below 1,000 feet the requirement is to be three miles in control zones, and one mile on airways or elsewhere. No distinction in required visibility is made between day flight and night flight.

GENERAL FLIGHT RULES. The most significant changes appear in the "General Flight Rules."

Minimum Altitudes. There will no longer be a minimum altitude for flight over open country. Over persons or places of human habitation the minimum remains at 500 feet; over congested areas, cities, towns, settlements and open air assemblies, the minimum remains as sufficient altitude to glide to a safe landing outside the congested area (but never less than 1,000 feet).

Maximum Altitudes. The restriction prohibiting private aircraft from flying above certain maximum altitudes will be abolished.

Flight on Airways. Contact flight on airways will be entirely free from restrictions, except for right-of-way rules. There are no specified altitudes; a pilot can fly on the right or left, or cross airways at will. Acrobatics may be performed if desired. Range approach channels, though still appearing on the aeronautical charts, are to be meaningless.

Flight at Airports. At airports the regulations are to be less strict than heretofore. The pilot must conform to the left-hand circular pattern for take-offs and landings, and must follow instructions of the control tower operator and must keep clear of other aircraft flying within the pattern. He may, however, fly over the airport at any altitude, in any direction, so long as he refrains from acrobatics.

IT FLEW HOME

DURING a recent operation in the European theater, this AAF *Flying Fortress* had its tail chopped off by another *Fort* while maneuvering over the target. The tail gunner was knocked clear and parachuted safely into enemy territory. The pilot then flew his mangled bomber safely back to its base 450 miles away, and made a crash landing with his wheels up.

Acrobatics. Much more freedom is to be permitted for acrobatics (the new term is "aerobatics"). Except over congested areas of habitation or over open air assemblies or within control zones, aerobatics may be performed anywhere at any altitude, provided the visibility is three miles or more. Parachutes are required during aerobatics if the plane is occupied by more than one person, but not for solo aerobatics.

A regulation which went into effect recently permits a private pilot to carry a passenger seated at fully operative dual controls; however, for aerobatics the controls must be disconnected unless the passenger is a certificated pilot. The ruling that a pilot may not fly aerobatically while carrying a pay passenger (except when giving instruction) remains in effect.

Reckless Operation. A new ruling states that "Aircraft shall not be operated in a reckless or negligent manner so as to endanger the life or property of another person." This statement is intended to keep pilots from abusing their newly-found privileges, and to place reasonable restrictions upon the freedom which is being granted in flight as well as in aerobatics.

Airspace Restrictions. Flight over restricted areas is subject to the same limitations as before.

Right of Way. No changes have been made in the right-of-way rules for overtaking other aircraft, approaching head on, converging, precedence or proximity. For instrument flight, the specified altitudes for flight on airways will be obtained from the control center; off airways the proposed altitudes are:

0° to 90°—at odd thousands
90° to 179°—at odd thousands plus 500 feet
180° to 269°—at even thousands
270° to 359°—at even thousands plus 500 feet

Basing Aircraft. A change which will be enthusiastically welcomed is the elimination of all restrictions upon the basing of aircraft. Under the new regulations pilots may land on and take off from any field and may stake their planes out overnight in their own back yards—an illegal procedure now.

War Emergency Rulings. The war emergency rulings do not appear in the proposed revision. Many of these may have to be retained until a release is granted by military authorities.

GENERAL SUMMARY. Language in the new regulations has been definitely improved. The former pseudo-legal phraseology is replaced by ordinary English which a pilot can understand.

Some further changes will undoubtedly be made in the general organization of the material to overcome obvious inconsistencies [such as are found in the use of the new term "General Flight Rules" and conflicting classifications brought about by the inclusion of a new subdivision known as "Part 43."] Then too, the simplification has perhaps resulted in the elimination of some items which it may be necessary to restore in order to give the regulations sufficient legal strength.

On the whole, however, the "proposed revision" is an excellent piece of work and a gratifying step toward improvement in the Civil Air Regulations.

Mr. Lankford, who has had general supervision of this work, expected to present the regulations to the Board for official action in January.

Delay in adoption may be caused by conflicting opinion as to what constitutes the best interests of aviation. As originally created, the Federal aviation agency was charged with the responsibility of fostering and encouraging civil aviation and was authorized to issue such regulations as were consistent with that purpose. It took the view that the development of airworthy aircraft, competent airmen and safe flying regulations was an absolute essential to make flying popular and thereby to promote the industry. When the Civil Aeronautics Board was

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created it took over the code of regulations based on this general concept and since that time has made the necessary alterations and revisions to keep pace with the growth of aviation.

Now the "proposed revision" will require a complete change in the previous philosophy of regulation procedures.

As stated in an introduction to the new proposals, and in a written statement by Mr. Lankford, the purpose of the new regulations is "to protect the lives and property of the public from careless flying, rather than to protect the pilot from his own carelessness." At the same time it is claimed that it has been the aim not to relinquish safety.

In view of the fact that private pilots will outnumber other civil pilots by thousands, considerable question has been raised as to whether such indifference to the fate of the private pilot could be reconciled with the original Congressional mandate "to foster and encourage flying," and whether the Board's primary interest should be to protect the public or to protect the pilot.

A case in point is the elimination of the minimum altitude requirements and the easing of restrictions upon aerobatics. Under the proposed revisions there is no prohibition of hedgehopping or of aerobatics at low altitudes.

Some objections to the proposed new regulations have been raised on the grounds that if these practices should result in an increased number of fatalities the interests of flying would be hindered instead of helped. The proper development of aviation is still dependent upon the extent to which the public can be assured that flying is a safe activity.

While this attitude can be fostered in some degree by accumulating excellent records of airline transport miles flown without fatalities, in the final analysis the average American will be far more impressed by the experiences of his friends and neighbors who have been bitten by the flying bug and are proud to be officially certificated private pilots. It is *their* safety record which will be the deciding factor when John Doe is considering taking up flying himself. If the public gains the impression that airplanes are dangerous, the entire aviation industry is bound to suffer. Professional men, business men and housewives will not only refuse to fly but will forbid their sons and daughters to have anything to do with airplanes.

These regulations place a great responsibility upon the pilot. The non-flying public will not tolerate airplanes as a nuisance. When the farmer discovers that his cattle are being frightened to death by hedgehoppers, and when he returns from his day's work to find that the roof of his barn has been lifted off by some acrobatic addict who misjudged by a few feet, there is likely to be a furious clamor for protective regulations. Such a clamor would be raised locally and we might soon find a crop of state laws and city ordinances that would make the present minimums of 500 feet for ordinary flight and 1,500 feet for acrobatic flight seem mild in comparison. Several cities have already taken official action in this matter.

Confusion and annoyance would inevitably result if state and local restrictions should become necessary to supplement the Federal regulations.

Then again, it is argued, the Board is likely to realize that in many cases it may be difficult to differentiate between what constitutes danger to the private pilot alone and what is potential danger to others. Some instructors feel that the flight test has been simplified to the extent that it no longer proves a pilot to be competent. They maintain that a pilot who has had no practice in forced landings and no experience in solo spins lacks the confidence and ability necessary to handle a plane under the unusual circumstances that are likely to arise. They also feel that the elimination of a compass and a fuel gauge from the required equipment is creating an unnecessary hazard. Without a compass the inexperienced pilot can more easily get lost; without a fuel gauge he may misjudge his reserve fuel; without fuel he may be compelled to make a forced landing (in which he has had no instruction), all of which could result in serious injury to the property or life of others as well as to the pilot himself and any passengers he might be carrying.

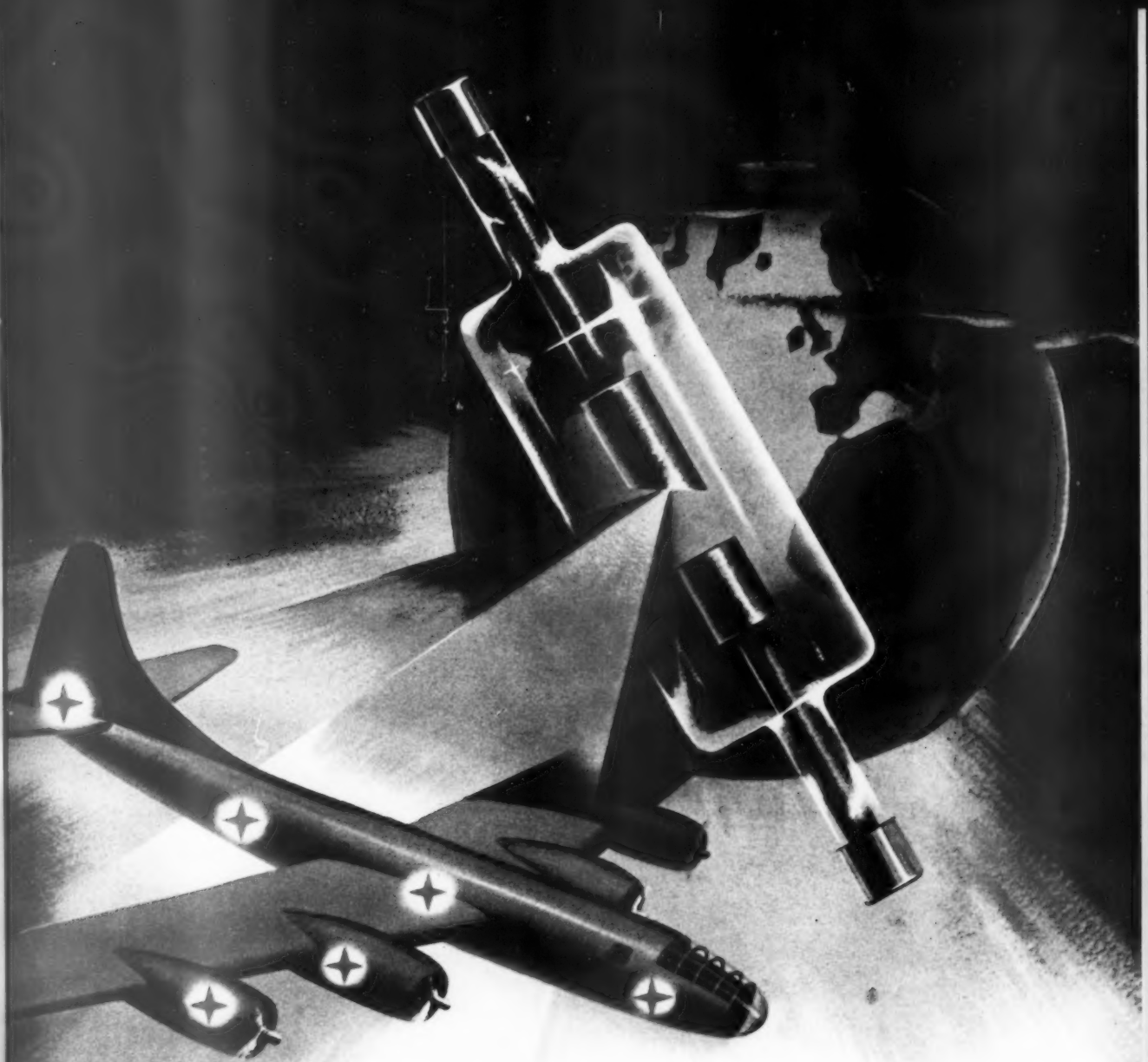
These are all matters which must be decided by the Board, but they are merely details in the over-all plan. The important fact from the viewpoint of the pilot is that the Civil Aeronautics Authority has already been at work to lessen his burden and is in the final stages of a project which will enable him to obtain his certificate with ease and to enjoy his hours of flying, unhampered by annoying restrictions. END

Birds and the Wind

(*Continued from page 45*)

though attended by waves and eddies—which are, as yet, imperfectly understood—its angular momentum in general varies from the poles to the equator inversely as the square of the distance from the poles. Only occasionally are the linear speeds of the two mediums the same. Generally where the speed of the air is greater than the speed of the earth we have our prevailing westerlies—where the speed of the earth is greater we have easterlies, or trade winds.

These and many other similar facts have, of course, been ascertained by study quite unrelated to ornithology. But man's limited knowledge of how best to use the wind has always been enhanced whenever he has taken time to study those creatures whose familiarity with its use seems most adequate. One of the most obvious lessons is that the way in which a bird is designed will govern how much or how little it can use the wind. Wing-loading, the ratio between wing area and weight; aspect ratio, the relationship between length and breadth;



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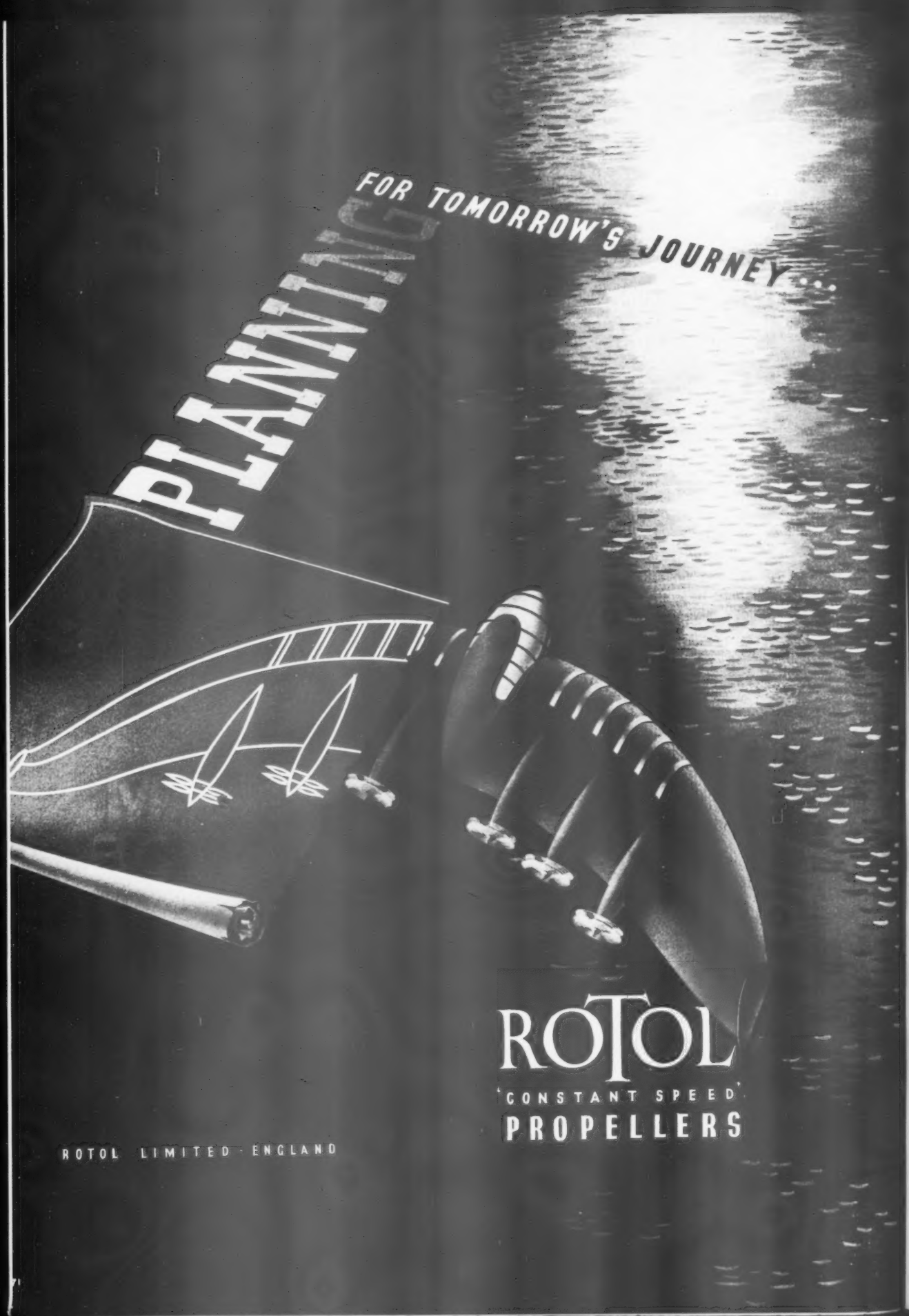
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camber, the thickness of the wings; dihedral, the upward angle of the wings; and the other problems that beset the airplane designer—all can be treated in a study of the flight efficiency of various birds. If a bird's flight equipment is such that it can make little use of the wind, its range will be restricted. If it can remain aloft with only slight effort, it will roam the wind from one corner of the globe to the other.

The shorter the blade of an airplane propeller, the more times per minute it must whirl in order to give the same speed. In his book *Why Men Can Fly*, M. K. Chapin points out that the same is true of the bird's propeller, or wing. A humming-bird's wing moves at the rate of 600 to 1,000 strokes a minute—the fly's wing, at 330 strokes a second! But the albatross or the condor, with wingspreads ranging from 11 to 15 feet, often do not use their wings as propellers at all, traveling simply as sailplanes or gliders.

The short, round wings and powerful muscles of the wild duck enable him to emulate the performance of the clipped-wing fighting plane, to do power landings and the like—while the huge wing area of the buzzard corresponds more nearly with that of bombing planes, slowing its flight but sustaining greater weight.

A quail takes off and climbs with the speed and steepness of a pursuit plane, Chapin says, but it cannot long maintain the great amount of energy which such flight entails. It gains altitude rapidly and then glides, preferably down-hill or down-wind. Its type of wings confines it to short flights, and it never wanders far from its birthplace. The dove climbs at a lesser angle and uses less energy. But without a great amount of lift it must fly rapidly to remain aloft. So, although it ranges farther than the quail, it falls far short of the yearly journeys of birds with more efficient wings—wings that use less energy and maintain lift with less speed.

But the longer flight of birds with more efficient wings is still dependent on the pattern of wind movement which, to all outward appearances, they know well. Captain McMillan tells of sighting a lone goose from his plane as he flew over southern Alabama on top of a solid overcast. The goose was riding a 30-m.p.h. east-southeast wind. Snap judgment, McMillan points out, might have it that the goose was lost and bewildered. But there might have been other reasons why it was riding a prevailing wind above the clouds that was totally different from surface currents. It would be foolish to insist that the goose "knew" that wind never travels in a straight line—that a small arc of it, like a section of the horizon, may appear to be straight but is in reality curved. But the fact remains that it was lazily riding a wind that, in its curving course, would carry it directly to the Mississippi flyway.

Visionary as this may sound, it is no more preposterous to grant the goose full knowledge of horizontal winds than to give definite knowledge of vertical winds to soaring birds. And one cannot watch the flight of a buzzard without admitting that it has a knowledge of, and is using, moving air. It gains altitude on a rising current. Using gravity for motive power, it noses down in a remarkably flat glide and descends more slowly than the air is rising. When it has exhausted the lift of the ascending current or wishes to change position, it sharpens its descent and glides swiftly across the neighboring downdraft. Whether it gains or loses altitude in the long run will depend on the length of time it is in the opposing currents rather than on the strength of those currents.

When using a thermal too small in diameter for it to turn in, the buzzard employs the same tactics. In the part of its spiral that is out of the current it moves rapidly. When it strikes the rising air it pulls up sharply; so sharply, in fact, that the end flight feathers of its wings open as do the slots of a "foolproof" airplane to prevent a stall and loss of flight control.

Such thermals, whether they be steady streams or a series of bubbles of hot air, resemble fountains. The air goes up but it also comes down. For every updraft there is a compensating downdraft and straight-way flight through them—either bird or plane—is pretty rough business.

But the upper limit of these convecting, or mixing, currents is layered over with a horizontal current of air into which the thermals cannot rise and where smooth flight can be maintained. This horizontal current is usually marked by a layer of smoke or dust the thermals have carried aloft.

Captain McMillan reports that it was just above this dust-level, near Port Arthur, Tex., that he passed a flock of 20

Photo by Underwood-Stratton

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Weems navigational instruments are to-day playing a vital part in guiding our fighting and bombing planes and air transports to their destinations through clouds, fog, wind, snow and sleet in all parts of the world.

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Lyon Computer (U. S. Geodetic Survey Type)	$ 3.00	Learning to Navigate	$2.00
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Link Bubble Sextant—Complete with carrying case and spare bubble	230.00	Weems Aircraft Navigational Plotter, Mark II complete with instructions. Standard with U. S. Air Forces	2.00
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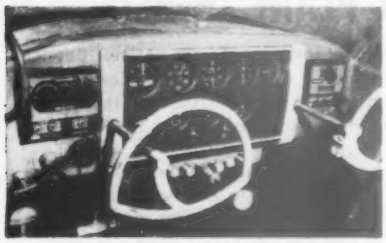
suggestions for safer, more dependable flying

1 —equip your ship with two-way radio telephone equipment

2 —use the approved procedures and phrases for two-way telephone communications

Pilots who have equipped their planes with RANGER transmitters and receivers are unanimous in their praise of the greater utility they secure from their ships—the added safety when in marginal weather —the convenience obtained when arriving at or leaving most airports.



Typical installation of RANGER model 108-B receiver and model 206 10.5 watt transmitter Receiver has 3105 kc spot besides 195-410 kc band, plugs for two sets of headphones and an inter-phone circuit Transmitter operates from 6 or 12 volt ship s battery through RANGER designed vibrator power supply

To further increase the utility of flying a radio-equipped plane you should use only approved phrases and sequences while carrying-on two-way communications—and should know about the many changes that have recently been made in these procedures. Thousands of copies of the RANGER procedure manual are helping pilots get the most from their radios—you are welcome to a copy for your use

Get this Manual FREE Already thousands of these manuals have been distributed through the Civil Air Patrol for use as their official training directive If you have not received one, send your name and address and we will immediately send your copy Contains the official CAA and Army procedures, sequences and phrases—also the phonetic alphabet and other data

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or more birds of a light brown plumage. The altitude was 7,200 feet—other aviators have discovered small birds at 10,000 feet and condors have been seen four miles up. McMillan's air speed was too great to permit proper identification of the birds, but the significant fact is that they were doing straight away flight aided by a 22-m.p.h. wind out of the west-southwest. There is no reason, McMillan insists, why the flock should not be credited with knowledge of horizontal currents equal to that which the buzzard displays in the use of the lower level thermals.

Further evidence for the record is contained in McMillan's story of the night he took an airliner off at New Orleans—bound for Atlanta—in a fresh southerly wind that increased in velocity to 60 m.p.h. Even with throttles pulled back to reduce air-speed, he arrived at Mobile and Montgomery far ahead of time. Northeast of Montgomery the warm air began to overrun cold air at the surface, as scud clouds beneath him attested. At Atlanta he landed down through these clouds into a cold northeast wind—although the southerly winds were still aloft. The next morning the woods just outside Atlanta were alive with newly-arrived migrants. The obvious deduction is that the birds had ridden across the Gulf and as far inland as they could before being forced aloft by the warm air running up the slope of the cold.

The deduction that birds know and use such currents is the most natural explanation, McMillan says, not only for their crossing the Gulf of Mexico on what is a veritable Gulf Stream of the air, but also as to why they follow rivers on valley winds; why they use mountain ridges and seacoasts when a quartering wind creates a surf that will give them both lift and direction; why the golden plover can ride non-stop from Nova Scotia to South America around the rim of the "Bermuda high" but cannot come back the same way. It explains, too, why land birds caught over water in a cold front or a strong wind shift must perish. This unexpected disruption of their "flight plan" caused by the battling winds will not allow them to retreat or advance.

For further interesting data, it is easy to check the "season reports" in any bird-lore or fish-and-game magazine. Change "cold weather" to "northerly winds" and "warm weather" to "southerly winds" and, when these wind forecasts are accurate, watch how the migrants arrive with the winds. Then check the similarity between a map of the migration routes and a map of the prevailing winds. And, finally, if you happen to be planning a little flying trip south just any time next fall, wait until the birds begin their annual hegira and you'll need no more proof that birds are the true veterans of the air lanes.

What is learned from studying bird migrations as the solar equator comes north in our spring and south in our fall —carrying with it the doldrums, the trade and anti-trade winds, the prevailing winds in both hemispheres—likewise can be expanded by noting the use birds make of off-shore and on-shore winds or of mountain and plain winds. Already they have taught some observers that maximum land and sea breezes come, not at midday and midnight, but in the afternoon and early morning.

Certainly, the wind has grown in its effects and importance to the aerial navigator. Men who first flew over water soon learned that surface wind is always perpendicular to the wave crest; that white caps, as they break, slide into the wind; that squalls and changes in wind are easily traced by the cross-chop on the sea surface. Other observers noted that wind directions tend to veer with altitude; and they set up a usable rule that at 1,500 feet the direction will veer 20 per cent right and its velocity will be 10 per cent higher than at the surface. It was learned also that surface velocity could be measured accurately by the character of the waves—rippled, white-caps, foamy.

Then came the development of drift-meters and usable computers. Gyro-stabilization, as in the B-3, or averaging, as in the B-5, proved precision DR entirely possible.

Along with these developments in celestial wind finding, meteorological prediction has grown more reliable. The old winds-aloft chart based on data taken from pilot balloons gave at best only rough indication of wind direction. Now weather stations post 10,000-foot pressure charts secured from radio-sonde observations which indicate wind direction from the isobars—wind above the friction layer being parallel to them. Wind velocities are obtained through use of a geostrophic wind scale for that level. Ingenious experiments and global-scale flying has increased our knowledge of air currents immeasurably.

But there remain inequalities, irregularities, waves and eddies that no man as yet fully understands. Our meteorologists, good as they are, are the first to admit that many of their theories are no more than theories. Most of them will admit, too, that until man has completely tamed the wind he can go right on learning tricks in predicting its behavior and effects from the birds. END

Airports for Everybody

(*Continued from page 42*)

"Even with the number of aircraft we had before the war, hangar and other facilities were being used almost at capacity and the substantial increase in personal aircraft which is expected after the war will make new small airfields in the cities a necessity. In metropolitan areas there also is a need to separate private flying from the ever-growing transport traffic; several large terminal airports found it necessary in the interest of safety to exclude private flying even before the war.

"In many of the smaller towns, as has been shown, there are no fields to accommodate either personal flying or transport service. The provision of fields at such places not only will fill existing needs but will serve to stimulate widespread aviation interest and employment in these areas through the commercial activities that airports attract." END

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It is only natural that we at TWA should be interested in the welfare of private flying. Many of our own executives and operations officials are pilots, and it is pleasing to us that TWA "Points the Way" for the many private pilots who prefer to make their cross-country flights over TWA's direct, convenient coast-to-coast route.
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★ **The "AOPA Pilot" for one year. This monthly publication is written by AOPA and contains important information for members.**

★ **Special AOPA Edition of "Flying" magazine for one year—with the "AOPA Pilot" bound into it. A monthly magazine with the largest circulation of any aviation magazine in the world.**

★ **A special AOPA mileage card for Hertz Driv-Ur-Self system with special rates, good anywhere in the U.S.A.**

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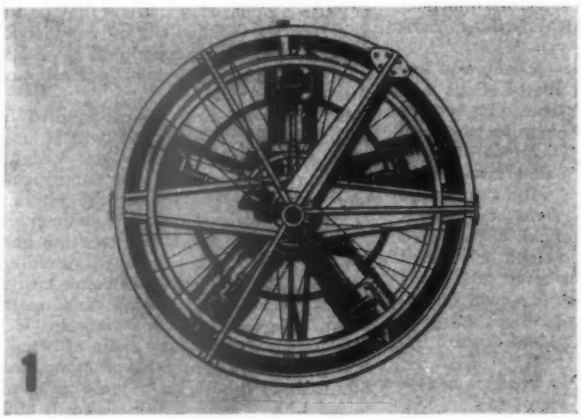
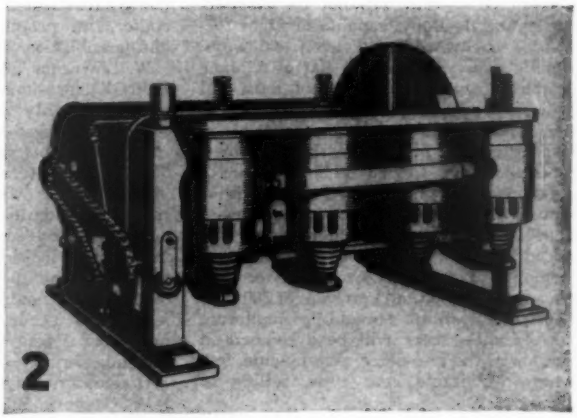
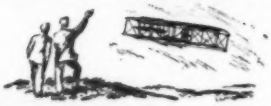
Can you name these famous engines?

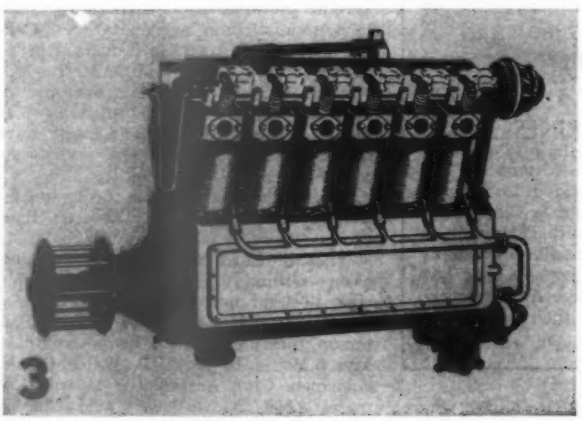


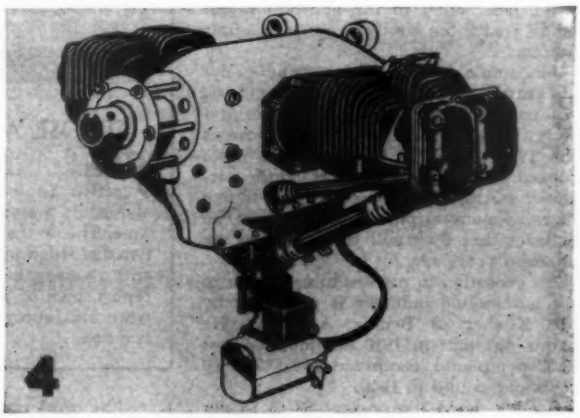


Accidents plagued the plane it powered, but this 125-pound great-grandad of all radial engines was a success. It developed 52.4 horsepower on crude auto gasoline. New Standard of California Aviation fuels, "tailored" to light-plane requirements, give today's small engines far greater horsepower per pound.



This four-cylinder model was mounted on its side. It made history on a sand dune, even though its first flight lasted only 12 seconds. Nowadays, with an efficient fuel like Standard Aviation Gasoline even the lightest planes can easily cruise aloft for hours at a time on swift, economical cross-country hops.





This famous engine was a World War I baby. It fought on 60-octane fuel, later flew early mail planes. For flyers in *this* war, Standard scientists helped perfect 100-octane gasoline. Their wartime research on Standard Aviation Gasolines will help give peacetime flyers safe anti-knock performance.

This one's easy to guess. Yes, it's an example of the kind of engine your post-war airplane may have. And, to make it more powerful, more dependable, to give it greater range, you'll want Standard Aviation Gasoline in its fuel tanks. Today, more than ever, Standard makes the finest of flying fuel.

STANDARD OF CALIFORNIA

STANDARD AVIATION PRODUCTS

THE ENGINES ARE: 1. Manly-designed engine from S. P. Langley's "Aerodrome." 2. Power plant of Wright brothers' first successful aircraft. 3. World War I Liberty engine. 4. Modern light-plane engine.

There's a Prediction for It

(*Continued from page 39*)

Both Piper and Hall concern themselves mainly with the type of future small airplane. They agree that the post-war plane will embody the familiar lines known today—and will not be a super-duper aerial jalopy, capable of flight forwards, backwards and even sideways. Piper's concern is production of a plane practically fool proof, but not darn-fool proof.

The ideas of these men are quite close. Hall suggests the possibility of three types of planes. First, the low-powered, inexpensive training type, with either tandem or side-by-side seating, priced at $1,000. For those with more money to spend there will be safe, medium performance airplanes, in two-, four- or five-place models listing between $1,500 and $3,000. For those demanding maximum performance, there will be a cleaned-up version of the two-place, side-by-side, low wing, retractable gear type, selling at around $2,000.

With production at maximum, Piper believes a dollar a pound per unit weight should be ideal. A $2,000 investment will thus buy a 2,000-pound airplane; $1,000 a 1,000-pound airplane.

Cantilever wing and tail construction, retractable gear and devices on the wing sections to provide increased lift on high-speed airfoils will increase speeds as much as 20 to 30 m.p.h. Still using engines from 50 to 80 h.p., Piper says, we should expect honest air speeds of 110 to 125 m.p.h. added to the ability for fast take-off with the family baggage and four persons.

Johnston of Curtiss-Wright believes flying grasshoppers priced at $1,500 to $2,000 will constitute the bulk of sales. He predicts the types will be basically those of the 1938 and 1939 models, a bit more rugged, more reliable and more airworthy. Although he predicts four to five times as many airplanes as at present, he believes that they will be designs of six to seven years ago.

An evolution in price similar to that in the automobile industry is predicted by Mr. Kucher of Bendix Aviation. He points out that in 1910 automobiles cost $1.52 per pound, compared with 35 to 60 cents per pound in 1940.

Scaling down the present $3 to $5 per airplane pound of today will bring planes now in the $10,000 to $15,000 price bracket to the ideal future cost of $2,000 to $3,000.

Mr. Burden, who predicts 450,000 private planes post-war, believes that in sufficient quantities the price of a four-place airplane should settle in the $1,500 to $2,000 price range.

Charles Stanton foresees a reliable conventional plane with a capacity of from two to eight persons and speeds from 90 to 200 m.p.h. The cruising range will vary, says Stanton, from 400 to 600 miles. Then there will be the non-stall, non-spin type of plane with two flying controls instead of three, incorporating the tricycle landing gear. This departure from the conventional type plane will carry from two to six persons at speeds of 90 to 150 m.p.h., and will probably cost from $1,000 to $10,000—a considerable spread.

Since this subject of lightplanes is being investigated, let's include the helicopter, its prophesied quantities, costs and possibilities.

W. Lawrence LePage [pronounced lee-PODGE], president of Platt-LePage Aircraft, is highly optimistic. He claims every economical advantage for the helicopter over the fixed wing type of plane of like size. He also claims low operating cost if the owner is willing to forego speed. He admits that some of the leaders in the helicopter field have stated these queer looking craft will be difficult to fly. But he does not agree, and points out that the novice could ascend only a few inches at first, gain the confidence necessary to soar higher, and acquire flying judgment.

Helicopters get quite a boost from Col. H. F. Gregory, Engineering Division, Materiel Command, U. S. Army. A low-priced helicopter might cost $5,000. There will also be, says Colonel Gregory, four-place sedans with 300- or 400-h.p. engines, luxurious cabin furnishings, roll-down windows, and an accompanying price tag of around $10,000.

He foresees helicopters capable of lifting gross weights of more than 15 tons, carrying 35 to 40 persons, plus a small amount of mail and baggage.

If adhering to present design, these helicopters would require rotors at least 70 feet in diameter and would have to be powered by engines of 2,500 h.p.

Do all the authorities agree with these gentlemen, and give us an assuring feeling regarding the helicopter's future? They do not.

Mr. Lothrop believes within two years following the war's end there will be a doubtful total of 2,500 helicopters.

C. Bedell Monro reminds all concerned to recognize the staggering engineering problems to be solved.

Mr. Burden believes the helicopter has a future but is still a long way off—perhaps 10 years.

Grover Loening believes the public is not ready for the helicopter for everyday use, emphasizing the fact that, so far, helicopters are difficult to fly, fundamentally limited in their speed and have definitely poor performance at increasing altitudes.

But after the war, when handled by professionals, the helicopter will be used widely and extensively. Mr. Loening predicts that the U. S. Coast Guard is almost certain to end up with 90 per cent of its air fleet in the form of helicopters.

The general consensus is that the helicopter still has to get out of its swaddling clothes. The predictions evidence lack of data on costs, both original and operational. Nevertheless Igor Sikorsky, who can probably justify any claim of being a true pioneer in this type of flying, sees hundreds of thousands of these small rotating winged ships within a decade after the war.

One gains the impression that no one, so far, really owns the key to the personal plane future.

Now about air transport, let's look at predictions on the larger planes, their capacities, costs and anticipated rates.

A large increase in air transportation, but with a comparatively small increase in the number of airplanes required is the prophesy of Curtiss-Wright's research business department. By 1950, Curtiss-Wright predicts, U. S. domestic and international airlines, and operators of Central and South America, Canada, Alaska, China, South Africa and Australia will operate 1,454 airplanes—an increase of only 289 planes over the 1940 total. The planes, on the other hand, will have larger seating capacities and their average performance will be better.

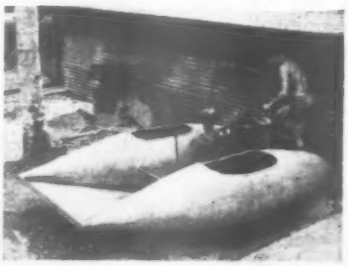
Other authorities include the same gentlemen who ventured to make predictions on the future of the private plane.

William Burden predicts 5,000 new planes within 10 years; S. Paul Johnston says 1,000 in four years; E. E. Lothrop guesses 2,050 in two years; William Patterson, president of United Air Lines, says 5,250 in 10 years; L. Welch Pogue, chairman, Civil Aeronautics Board, estimates 2,000 in two years and Charles Stanton 5,000 within five years. Obviously the predictors are not all peering into the same crystal ball.

Do our guides into the future agree on what rates will be charged the traveling public?

Using 10 years or more as a basis for setting the future rate per passenger-mile, Burden thinks it will be 30 per cent below present Pullman rates; Curtiss-Wright Study, 3½ cents to four cents; Johnston, three cents; Patterson, three cents to four cents; Pogue, 2½ cents to four cents. To this is added an anticipated rate of 3½ cents by A. N. Kemp, American Airlines' President, and one of 2½ cents by E. P. Warner, Civil Aeronautics Board vice chairman.

(*Continued on page 134*)



THOSE MARINES . . .

SEVERAL Marine airmen at Espiritu Santo decided to build a makeshift motor boat in their spare time. This is the result. Their recipe: two discarded jettisonable wing tanks and a salvaged jeep motor. At last report, men of Marine Air Group 11 were still enjoying their noisy contraption.

Water Injection Corrosion

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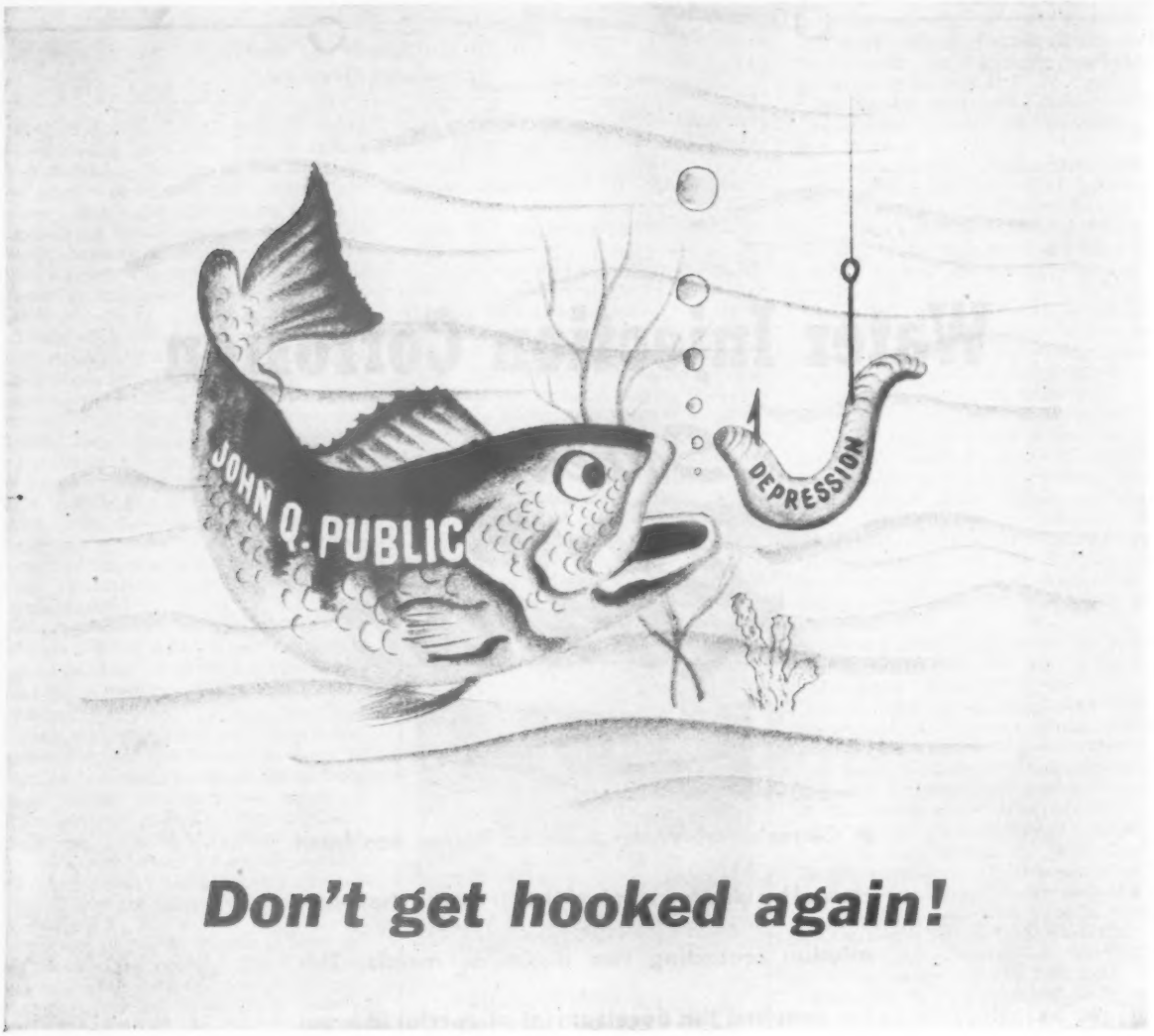

Don't get hooked again!

Only yesterday (YOU remember!) men sold apples on the streets, saw their furniture go back to the store, lost their houses, lost their farms. Will it happen again? It needn't.

But to avoid the kind of depression we had after the last war—WE MUST HEAD OFF INFLATION NOW! And the best way to do that is to save your money.

When you don't buy a thing you can get along without . . . *that's helping to prevent inflation.* When you decide this is a bad time to ask more money for the things you sell or to fight for a raise . . . *that's helping to prevent inflation.* When you pay up all your debts . . . *that's helping prevent inflation.* AND SOMETHING MORE!

It's the best way to protect yourself against a depression if one should occur, *and* the best way to prepare yourself for tomorrow's opportunities if times are good.

The smart thing today is to save, not splurge. Don't get hooked again!

4 THINGS TO DO to keep prices down and help avoid another depression

1. Buy only what you really need.
2. When you buy, pay no more than ceiling prices. Pay your ration points in full.
3. Keep your *own* prices down. Don't take advantage of war conditions to ask more for your labor, your services, or the goods you sell.
4. *Save.* Buy and hold all the War Bonds you can afford—to help pay for the war and insure your future. Keep up your insurance.

HELP US KEEP PRICES DOWN

A United States War message prepared by the War Advertising Council, approved by the Office of War Information, and contributed by this magazine in cooperation with the Magazine Publishers of America.

"More luxurious over-weather travel now a certainty"

By **JACK FRYE**, PRESIDENT
TRANSCONTINENTAL & WESTERN AIR, INC.

Before the war, we at TWA began work on a super-luxury plane. The Constellation — built to carry 57 passengers in air-conditioned, over-weather comfort at pursuit ship speeds — is now in military service.

The kind of thinking that produced the new Constellation has not stopped. In the future, you may count on amazing travel luxury in faster giant planes. It's a postwar certainty.

EXAMPLE:

AiResearch "comfort-protected" airliners

WHEN PEACE COMES, you'll find how wartime aviation engineering has opened the sky roads, paved them for commercial flight. Then, you will experience in *airliners* many of the developments that have given our warplanes new flying advantages.

Yes — and new flying *comfort*. That will be AiResearch's part.

For instance, from our military developments for high-altitude flying will come "comfort-protected" cabins. These will be equipped with an AiResearch control which eliminates altitude-pressure-changes that cause headaches, dizziness and ear-popping. This AiResearch control seals a *low altitude* inside the cabin . . . keeps you in "living room comfort" while your airliner takes off, while it lands and even when it flies thousands of feet high!

There will also be AiResearch *temperature control* systems to keep your cabin cozy-warm through sub-zero weather, refreshingly-cool through the tropics. And smoke-free and odor-free at all times.

Yes, the "know how" we are gaining today will make your life more pleasant tomorrow — on sea and ground, as well as in the sky. AiResearch Manufacturing Company, Los Angeles and Phoenix.

ARMY E NAVY

"Where Controlled Air Does The Job" • Engine Oil Cooling Systems
Supercharger Aftercooling Systems • Engine Air Intercooling Systems
Temperature Control Systems • Automatic Exit Flap Control Systems

AiResearch
DIVISION OF
THE GARRETT CORPORATION

(*Continued from page* 130)

With transoceanic travel just over the horizon, the guesses as to rates are a long way apart. Two executives of the same airline aren't even close. A. N. Kemp predicts a one-way fare to Europe of $100 whereas Ralph Damon suggests $360 as the possible fare. Both are American airlines executives.

Glenn L. Martin anticipates a one-way fare of $225, with the round-trip costing $400. Agreeing with Martin is William Burden, who believes a fare comparable with that of the pre-war minimum first class passage on the *Queen Mary*, or $250, will probably apply.

If such fares hold on other airlines, Pan American Airways will do a land-office business. It has released a hypothetical timetable for 1948, indicating a rate of $186.30 for a round-trip flight between New York and London. This is approximately half of Damon's estimate for a one-way fare.

Obviously, the airline must derive revenue in excess of its expenditures in order to thrive. It all reverts back to the airplane itself. Therefore, predictions as to the size and type of aircraft should remain constant and consistent.

There is a semblance of accord on plane size, and this can be attributed to the major air transport manufacturers. Competition requires their keeping pace with rivals. Airplanes capable of substratosphere flight, or in excess of 30,000 feet, will probably be commonplace at the close of the war. There will be the *Constellation*, *Stratocruiser*, *Celestialiner* and probably others still in the design stage. Our authorities agree they will all use four-engined aircraft of this type for transcontinental service, averaging approximately 70 passengers, cruising at from 265 to 300 m.p.h.

These, then, are some of the predictions. They are derived from varying sources and consider varying factors. Some attempt to survey present public opinion to determine interest and intentions of purchase. Others graph the industry itself and extend the line of growth into the future. Still others attempt to find a parallel between the growth of the automobile and that of the airplane—or even farther afield, with the growth of radio or mechanical refrigerator ownership.

All such predictions have their good points—and their bad ones. Who can know, for example, what the economic health of the nation will be for the next 10 years? No one who remembers that only a handful of personal planes were manufactured in 1933 can forget the overweening importance of prosperity or depression.

Nor can anyone grasp the full implications of new construction materials—of metals that are stronger but weigh only half as much, of new plastics and plastic-bonded plywood, of roadable planes, of new helicopter developments. Gasoline now available develops unheard-of performance and economy, and will increase payloads correspondingly by cutting down weight and fuel consumption.

All these things will affect the validity of any predictions. Predicting is difficult. The future has the answers and second-guessing is easy. Here is what aviation authorities think of the future today. Which ones will aviation prove right tomorrow? END

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Walt Disney's Animated War

(*Continued from page* 51)

ning Lights", "Turning Lights", and other kindred themes. Disney staff members worked with Comdr. Raymond Farwell, USN, former university professor and author of books on navigation, to make the series.

The film avalanche gathered momentum with the arrival of Lieut. Comdr. J. C. Hutchinson, USN, at the Disney studio to aid in the production of the WEFT series. Hutchinson explained that he wanted between 20,000 and 30,000 feet of film that would teach Navy personnel to identify aircraft—that the Bureau of Aeronautics needed such a training device immediately. An order for 90,000 feet of film, to be delivered within three months, was placed—and Disney with a studio that had been producing only 27,000 feet a year. Production of the WEFT series started with a unit of about 14 men, including two directors.

WEFT stands for "wings, engines, fuselage and tail." The series combined cartoon technique and the work of live actors. The project developed so smoothly that in many cases Disney was fighting for planes to use in the cartoons even before they came off the production lines. The first two reels of the series were devoted to explaining the WEFT identification technique, the rest to the various aircraft which were to be identified by the "students."

Shortage of actual planes and identification models led Disney to utilize personnel questionaires in discovering the men in his employ who made model planes as a hobby. The scale models which they built were used in producing the film. In a later emergency this same procedure unearthed staff members who were authorities on electricity and electronics.

As the WEFT series went into production for the Navy other branches of the service became interested. The series itself was simple compared with what followed—the aerology series.

The new series, which came into being at the request of the Navy Bureau of Aeronautics, really created havoc at the studio. The request was to "do something about weather condition." At the time the work began there was little practical knowledge concerning global weather. But planes were beginning to fly where they had seldom flown before. Textbooks were available but the information pertaining to flying was sketchy and unreliable.

It was found that the cartoon technique plus color made it possible to produce the film from *the pilot's viewpoint*. The weather world could be shown as it was to be seen from the pilot's cockpit. Those privileged to see the aerology films—

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"Warm Fronts," "Cold Fronts," and "Occluded Fronts"—agree that the sensation produced was that of being a co-pilot during a storm and having a pilot with thousands of hours counseling and guiding through the rough spots.

Pilots, meteorologists and anyone else who knew about global weather were appointed technical advisers and asked such questions as "What does a cold front look like?" "On hitting a warm front would you fly over it, under it, or try to go around it?" "If ice started forming, what would you do?" "Would you fly under the light part or the dark part of a cloud?"

At first the aerological series was under the direction of Lieut. Newton Lieurance, who was the principal advisor on the first three instruction features. Comdr. Fred A. Barry, then head of the post-graduate course on aerology at Annapolis, took over from there and supervised the nine remaining pictures.

It was about this time that a veteran of Pacific fighting returned to the United States. He had been at the head of one of the fightingest of Navy squadrons. His name was J. C. "Jimmy" Thach, a Navy commander credited with training the famed "Butch" O'Hare and other aces and with development of the "Thach weave," a new fighter technique.

Enlisting Thach's expert assistance, the Navy ordered 10 pictures on fighter tactics. The completed job was to run from 15,000 to 20,000 feet and to cover every phase of fighting the Jap. Subjects included defense against bombers, defense against pursuits, attacking procedure, ground strafing, illuminated sight and fixed gunnery, fundamental approaches to targets, bombing, dive bombing and many other subjects.

When Thach wound up his chore, Lieut. Richard Crommelin, USN, one of the famed five Crommelin brothers, took over. Crommelin had fought and had been shot down during the Battle of Midway, later fought in the Battle of the Coral Sea.

The torpedo series brought to Navy projection rooms the story of the torpedo. Nomenclature, construction and principles of operation for both aerial and under-water torpedoes went into the series. Launching tactics used by torpedo planes were also featured.

Army interest in the Disney technique dates back to the time the WEFT series was devised for the Navy. It was requested there be more Army planes in the identification series. Subsequently, seven or eight pictures were created and turned over to the Army. About 8,000 feet of film went through processing to fill the order.

The Disney boys really went to sea when the carrier series was requested by the Navy. Training a Navy pilot presents plenty of problems. For instance, it was necessary to spend long hours teaching the fledgling to take off and land on carriers by putting a flight deck and equipment on dry land. After this first step, the tyro went to sea and learned how to handle his ship on a real deck. Could the training period be shortened and the young pilot be given a more comprehensive knowledge of technique through an illustrated film? The Navy and Disney thought so. Disney's solution was a complete series of films taking the young pilot from the time he made his first take-offs and landings from the land-based "carrier deck" until he mastered the procedure of getting off and on an actual carrier flight deck. Each step was portrayed on the screen, with a skilled narrator instructing him. Such films have measurably shortened training time—and they will live after the war is over as Navy "text books."

A later VTB series on torpedo-bomber training for Navy pilots involved 9,000 feet of production. The series included pilot training and torpedo plane familiarization, depicting the torpedo in flight, torpedo launching, attack against bombers and escort technique.

Disney's men shot about 100,000 feet for the armed services and Allied governments in 1942. In 1943 they jumped the output to 200,000 feet. The studio's commercial, or "theatrical" output fell to a dribble. Movie fans, once used to seeing at least 18 Disney short subjects and a full length feature each year, in 1943 got only "Victory Through Air Power" and a handful of shorts.

The public did get a few breaks in 1942 and 1943 that were quite unexpected, however. Disney was called upon to supply animation which contributed a great deal to the success of a series of pictures produced by Col. Frank Capra, former Hollywood director, for the United States Army. This series included "The Nazi Strikes," "Prelude to War," "Divide and Conquer," "The Battle of Britain," "The Battle of China," "The Battle of Russia," and "America Goes to War." Colonel Capra's pictures were so well received that some were released to theaters, although they were originally intended solely for servicemen.

But this wasn't all. Three aircraft and parts manufacturing companies—Beech Aircraft Corporation, Minneapolis-Honeywell and Aeronca—were faced with the problem of teaching the services to care for their products. They requested Disney to make educational films for distribution to service personnel. Beech got 20,000 feet. The topics covered were care of landing gear, wheels and brakes, flight controls, changing of engines, maintenance of service controls and general handling. The subjects were developed in such a way that they aided all ground crews. In addition there was considerable footage devoted to airplane wood repair.

For Minneapolis-Honeywell, Disney produced a three-part work on pilot theory, as well as film treatises on pilot training instruction, pilot training instruction for the *Fortress*, function and care of the servo motor, the flight gyro, amplifier, stabilizer gyro, standardized trouble shooting, basic electricity and basic electronics.

For Aeronca, Disney covered in part glider training, flying operations, functions of instruments, and general air work. Through the Army, he managed to get two Aeroncas to the Pacific Coast and used them in making the production, which ran 12,000 feet.

(*Continued on page* 138)

"Something tells me we're not over Indiana"

If you were to ask expert opinion as to what is responsible for the rapidly expanding *range* of aircraft you would get many answers.

An aerodynamics expert would point out the increased efficiency of new airfoil designs. An engine designer probably would point with pride to modern engines. A propeller expert might show the part his specialty plays.

You probably wouldn't find anyone outside of the petroleum industry who would mention *gasoline* . . . or Ethyl fluid.

Yet the gradual stepping up of aviation gasoline from about 65 octane to 100 and upwards through new refining methods and the use of Ethyl fluid, is one of the basic reasons for greater and greater flying range.

A tank full of 100-octane gasoline weighs no more than a tank of 90 octane gasoline. It takes up no more room. Yet in combination with engines designated for high-octane fuels, the tank of 100 octane may be worth up to a tank and a quarter full of 90 octane in extra range.

What the equivalent of tankfuls of future higher antiknock gasoline will be, no one can say. But an important factor in future air-travel, whether military, commercial or private, is the rapid improvement of aviation gasoline.

Ethyl Corporation

ETHYL

CHRYSLER BUILDING, NEW YORK CITY

(*Continued from page* 136)

One film which will live for years is the story of the turbosupercharger, which was made for the Army Air Forces. Nomenclature, principles of operation, functions, and limitations are treated.

When the Air Forces deemed it advisable to supplement existing bomber-training methods with animated visual education Disney again was called upon. Staff members took their equipment to air fields, climbed into bombers and proceeded to film such subjects as "precision bombing" and "the use of bombs."

The Bureau of Aeronautics decided that "blimp" observers would be better trained if they could see pictures of a submarine surfacing and submerging, Disney technicians rode the blimps over the oceans to make a special reel in order that observers who had never seen a submarine from the air might know what to look for.

For the Co-ordinator of Inter-American Affairs, Disney turned his cameras on Central and South America. An enthusiastic air passenger and a pioneer in the "good will" movement, he initiated work on this assignment with a three-month flying trip below the border. His experiences were entertainly recorded in "Saludos Amigos" and "The Three Caballeros," featuring Donald Duck, Jose Carioca, the jitterbugging Brazilian parrot, and Panchito, the Mexican rooster.

At this writing Disney men have been in the Amazon River basin for six months, preparing the Inter-American feature. At the Burbank studio films in Spanish are being readied covering health subjects, education and welfare. END

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AMERICA'S OLDEST INSTRUMENT SCHOOL

Report From Washington

(*Continued from page* 48)

ter visibility, quieter (pusher types favored), roadable (with or without wings), capable of landing cross-wind, and inexpensive.

"Compromises never survive" have become by-words among some leaders in the industry, but Mr. Geisse replies that the automobile is already a compromise between a cross-country and a city vehicle. With parking and low gas consumption major considerations in city traffic, a more ideal vehicle would be small, light, maneuverable. He adds that a roadable plane would answer both cross-country and city needs better than any vehicle now in operation. Now that he's begun to build the ideal post-war plane; funds are needed for the work, and will have to be provided by Congress.

Wright Stands Pat

Administrator Wright not only backed up Geisse within the CAA but also came out publicly for the aircraft development program. Little-known is the fact that the industry immediately protested CAA's "delving into a phase of the development and manufacture of civil aircraft." The quotes are from a letter to Wright by John E. P. Morgan, chairman of the personal aircraft council of the Aeronautical Chamber of Commerce, who goes on:

"The manufacturers feel that the development and engineering of aircraft types is their individual responsibility and prerogative and that good hard competition in the industry is the answer to technological development. They, therefore, would probably jealously desire to retain this activity to themselves individually. It is their understanding that the CAA is an administrative agency and . . . therefore its interest is academic and not operative." . . . Wright replied immediately saying that "all in all, I really feel that the industry is possibly a little overconcerned with its prerogatives and a little too suspicious of activities on the part of CAA which have not been inaugurated. However, I can assure you that we sincerely feel that it is our duty to 'encourage and foster' private flying and I further hope that we can get together . . . to discuss this at greater length." Discussions are going forward as this is written.

G-Suit

Reports from the European front coming into Washington indicate that another technical victory has been won over the Germans and Japanese in the form of the AAF G-for-Gravity-suit, a sort of pressurized Mae West with legs. It consists of air bladders, which fit over the abdomen, thighs and calves. The bladders may be inflated in two seconds by the plane's vacuum instrument pump, and have worked wonders in preventing blackouts. Pilot quotes on the G-suit are enthusiastic: "I've nicked six Jerries in mine," "I racked my ship in a 180° turn to destroy a plane," "It's the best thing anybody did for us," and "I wouldn't go on a mission without it," are among the testimonials from *Mustang* and *Thunderbolt* pilots of the Eighth and Ninth Air Forces, where the suit is in general use. Theoretically, the G-suit provides the pilot an extra tolerance of only 1.9 G, but the boys report that they are unable to black out when wearing it.

The technical victory over Germans and Japs is evident in their makeshift solutions of the same problem. German approach to blackout was in plane design, and they experimented for some time with having the pilot fly in a prone position before rushing an inadequate G-suit into production. With characteristic disregard of the individuals involved, the Japs simply tape their boys around the waist and upper legs with tight, inelastic bandages. This works, after a fashion, although it is acutely uncomfortable and restricts the pilot's movements.

Big Wind

Two wind tunnels, each capable of testing large model airplanes at speeds in excess of 700 m.p.h., soon will be available to the nation's aviation industry. One is on the west coast and is financed by Consolidated, Douglas, Lockheed and North American. The other is on the east coast and is wholly owned by Curtiss-Wright. The west coast tunnel will be operated by the California Institute of Technology and the east coast installation will be available to all eastern aircraft manufacturers. Total cost of the two tunnels, which are almost identical, will be about $5,000,000. Designing them was a joint project shared by Dr. Clark B. Millikan of Caltech, and Dr. Norton B. Moore, Curtiss-Wright aerodynamic engineer. While not the largest in the U. S., the tunnels will permit testing at greater speeds than is now possible in others. For example, research engineers will be able to learn what happens to a plane diving at nine-tenths the speed of sound. (Sound travels 13 miles a minute or 760 m.p.h. at sea level.) Both installations are closed-circuit affairs equipped with two controllable-pitch propellers each measuring 21 ft. 10 in. The horsepower

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4 **P-39 AIRACOBRA**—Tactical pursuit ship and ground strafer.
5 **P-63 KINGCOBRA**—Greater range and speed than the P-39.
6 **P-70 MIDNIGHT MAULER**—Night-fighting version of the famous A-20.
7 **B-25 MITCHELL**—Medium bomber with a 75 mm. cannon.
8 **P-51 MUSTANG**—All-altitude, high-speed pursuit fighter.
9 **SB2C HELLDIVER**—Our Navy's powerful carrier-based dive-bomber.
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of the main drive connected with the wind-generating fan is about 12,000.

Gas-Saver

That the automatic direction finder would ever turn up in the role of a gas-saving device would seem stretching a point, but that's exactly the part it played in negotiations between the Air Transport Association and the Civil Aeronautics Administration which were successfully completed here recently with an official letter from CAA. Signed by James L. Kinney, chief of the CAA air carrier division, the letter made official what ATA has been campaigning for more than a year—the right of transports to shortcut off the airways when ADF can be safely used. CAA will require proving runs on the ADF routes, but indicates that decisions will be quickly made and generally favorable. More than 75 shortcuts have already been proposed by the operators. In charge of negotiations for ATA was John Groves, former manager of Washington National Airport. The campaign to make the changes has been going on for five years and, ATA estimates, will result in huge savings of aviation gasoline.

Incidentally, ATA is planning expansive activities to sell the public on post-war air transport. Perley Boone, the organization's new public relations man, is going ahead on the theory that too much air transport selling has been done within the trade—where it is least needed—and that non-aviation business men, little and big, as well as the general, non-flying public, should be educated on the values of flying. It is understood that ATA is prepared to back up the Boone idea with heavy appropriations.

Briefings

AAF's drive to conserve rubber is inpired by the fact that the nation, including the armed forces, is faced with critical truck and plane tire shortages, the worst since Pearl Harbor. Grounding of aircraft and stalling of ground combat vehicles is threatened. AAF meantime is making every effort to improve preventive maintenance, salvage, reclamation, and adjustment of inventories. . . . Air transport figures will go beyond the 1944 all-time high, ATA officials are predicting. Final '44 estimates on domestic lines included 62,133,104 pounds of express, more than 85.8 billion pound miles of airmail, 3,658,140 passengers. Nearly two million of the passengers traveled on priorities having direct bearing on some phase of the war effort.

Wayne Weishaar, press agent for the Aeronautical Training Society, reports that their recently-completed survey shows more than 19 per cent of men now in the armed forces aspiring to a post-war aviation career. The figure is lower than was expected but shows, says Weishaar, that "more of our fighting men want to go into aviation than into any other industry or occupation." . . . After six weeks in the Pacific theater as chief correspondent for INS, Joe Bors, one-time writer in FLYING, wants us to back a new decoration for correspondents which will bear a cluster of beer bottles and will be given for 50 missions across Waikiki beach. . . .

State Department aviation experts are disturbed over the need in South America for airports large enough to accommodate the DC-7's, *Constellations* and other big jobs being planned for service there by U. S. operators in those areas post-war. As things now stand, Chile has only one big port. Venezuelan officials say they could use six more, and similar shortages are reported from all 20 of the republics. . . . We now can report that the mystery of the Douglas B-19 is no longer a mystery. At Pearl Harbor when the attack came, it was flown to parts unknown. Turns out that it went to Wright Field. Since then, it has been used as an experimental plane and, most recently, Allison took it over and installed four of their new, 2,600-h.p. inline engines. We have no dope on performance, but understand that the B-19 now has a ceiling well over 40,000 feet, compared with its former ceiling of only 20,000. . . .

Jacqueline Cochran of the WASP is still on active duty, and expects to continue so for at least a couple of months. She's cleaning up WASP affairs and writing a complete history of their activities. . . . Quotable quote from Rear Adm. H. L. Merring: "In the hard work of war, the ground troops, the air forces and the Navy must function as a team. And this is as true at home as it is abroad. The services have worked together—and are working together—on the war production job. At the same time, we are working closely together on industrial readjustment, which is a vital part of the war production job."

—FRED HAMLIN

Atlantic Weather Patrol

(*Continued from page 32*)

out just how much of a change occurs led to the abandonment of the wet bulb readings and the development by the Signal Corps of a new psychrometer, wherein the airstream is slowed down relative to the plane to a speed at which no appreciable heating occurs at the thermometer bulbs. Very complicated corrections still must be made, but they can be exactly determined. It is now possible to measure relative humidity from an airplane with an error of only one or two per cent.

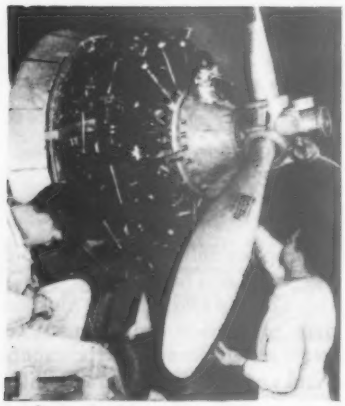
More important even than temperatures to meteorological forecasting are the winds aloft. Wind fixes were made possible by special radio navigation equipment which afforded a ready means of determining the wind directly when such standard methods as double drift observations were not possible. It was found that not only winds but barometric pressures could be ascertained through the combined use of pressure and radio altimeters.

A pressure altimeter is merely a sensitive aneroid barometer provided with a dial which translates pressure into altitude according to an assumed relationship. It has a sero-setting device to take into account variations in the sea level pressure. For any given setting, it is always possible to convert an altitude reading in feet into pressure millibars at flight level. And flight level is determined by the radio altimeter which, over the ocean, measures the exact height of the airplane above the water surface.

From the pressure at flight level the meteorologist can easily calculate the pressure at the standard levels (such as 5,000 and 10,000 feet) for which he draws his upper air charts. A line of such hourly observations from a plane flying across the Atlantic fills in some very empty spaces on his map.

Still another use is made of the readings from pressure and radio altimeters. A plane flying at a constant pressure altitude is flying along what the meteorologist calls an "isobaric surface"—an imaginary surface in the atmosphere over

(*Continued on page 144*)



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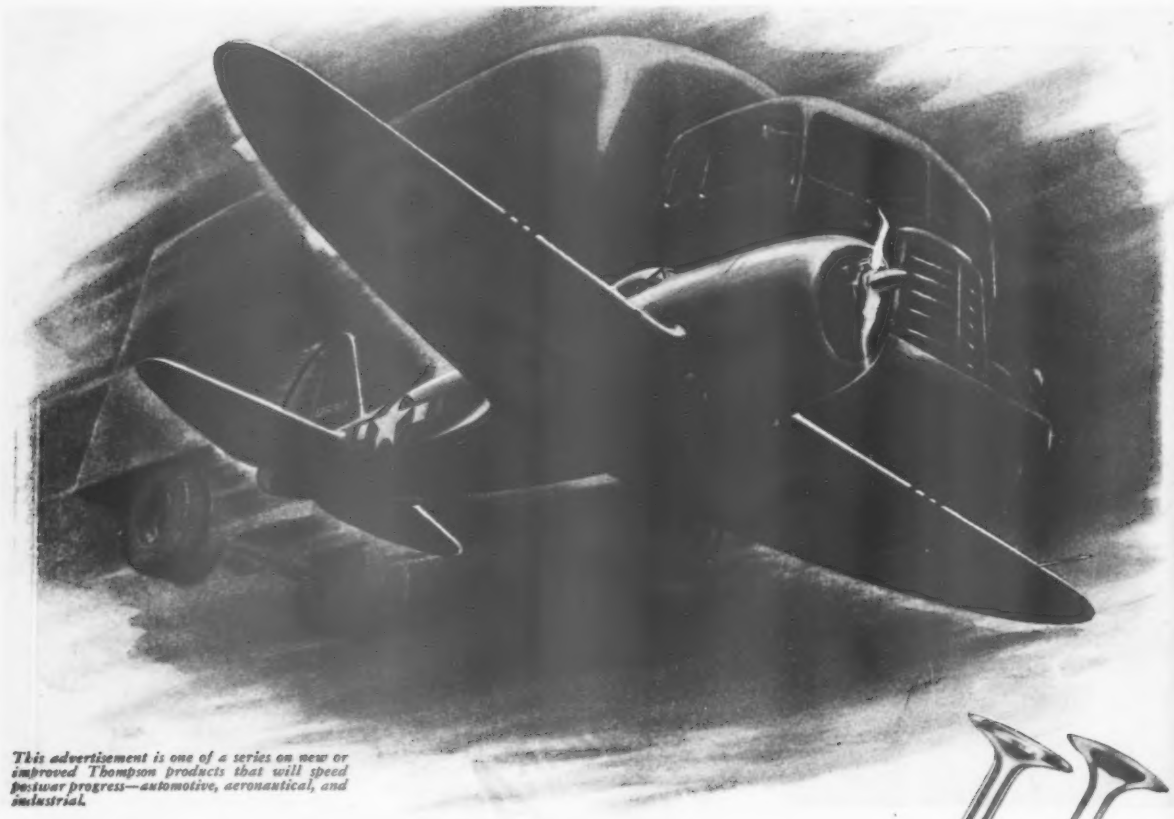


This advertisement is one of a series on new or improved Thompson products that will speed postwar progress—automotive, aeronautical, and industrial.

We picked this out of the air

● At the end of the First World War, with top flying speeds around 100 miles an hour, the life of an aircraft engine valve was about 50 flying hours.

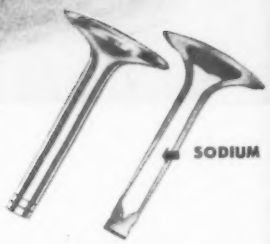
Today Thompson aircraft engine valves often operate over 5,000 hours —1,000,000 air miles—before replacement is necessary.

Behind this valve evolution is a story of unremitting search by our engineers, metallurgists and factory men for new steels, improved designs and new production methods to combat three great enemies of valve life—heat, pounding and wear. This research continues today, and always will. For a modern aircraft exhause valve must resist the burning and warping attacks of white-hot engine gases, and it must stand up to a rapid-fire barrage of "hammer blows"—1500 to 2000 a *minute*—as it opens and closes.

In such an inferno even the finest alloy steels, alone, were not enough. Something had to be added *inside* the valve to speed the heat from the valve head. First, years ago, ordinary lithium and potassium nitrates were put into a hollow valve stem. Now metallic sodium is inserted in a valve with both the head and stem hollowed out. How to forge such a valve was in itself a problem that took years to solve.

Today every type of American fighter, bomber and transport plane, and many other military engines, are equipped with Thompson Sodium-Cooled Valves.

Soon after the war this aircraft-type valve will be built into heavy-duty truck, bus, tractor, and other engines. Eventually you may be enjoying the improved operation, power and economy of a passenger car engine fitted with the valves "we picked out of the air".



THE THOMPSON SODIUM-COOLED VALVE FOR AIRCRAFT ENGINES

Cross-sectional view at the right shows how Thompson aircraft exhaust valves are filled about 60% with metallic sodium. The sodium liquefies under engine heat, splashes the inside surfaces and rapidly carries heat away from the red-hot valve head. Forged from finest steel and super-finished or nitrided, this valve is built with watch-like precision.

THE NEW SODIUM-COOLED VALVE FOR TRUCKS AND BUSES

Above is a pre-view of the postwar Thompson Sodium-Cooled Valve for heavy-duty truck, bus, tractor, marine and industrial engines. It is now used in the engines of many military vehicles.

Thompson Products, Inc.

THOMPSON AIRCRAFT PRODUCTS CO.

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PIONEER PARACHUTE COMPANY, INC.
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CABLE ADDRESS: PIPAR. TELEPHONE: Manchester 4157

WEST COAST FACTORY BRANCH, 109 SOUTH CENTRAL AVENUE, GLENDALE 4, CALIFORNIA

(*Continued from page 140*)

which barometric pressure is everywhere constant. If the airplane flying at this constant pressure altitude measures its absolute height from time to time, it is also measuring the variations in height of that isobaric surface, somewhat as a surveying party measures the variations in height of the earth's surface.

From all this data the meteorologist can determine the force of the wind perpendicular to the true heading at the plane's flight level and its subsequent drift, or angle at which the wind is blowing him off course. This is of considerable value to a plane not equipped with the new radio system of navigation—equipment much less common than a radio altimeter—for the method can be used when neither sky nor sea is visible from the plane.

Accompanying all such instrument data were the direct visual observations made by the trained forecaster-observers. The extent and kind of clouds, the amount and duration of icing, the severity of frontal systems—all these were carefully recorded on cross-sectional charts of the atmosphere, reported to the forecasters on each side of the ocean and subjected to later research and statistical analysis.

A few figures will show the amount of material available for such analysis and indicate the scope of operations. From the first flight on January 7, 1944, to the end of March, these airplanes made 40 round trips between North America and the United Kingdom with a few shorter trips to Greenland and Iceland. Total flying time amounted to 945.5 hours. The weather officers drew 113 atmospheric cross-sections (one for each flight between any two terminals) and passed through 88 fronts. The highest altitude flown was 23,500 feet; the average was near 10,000. Length of continuous flight ranged from slightly more than two hours to 17.5 hours, the latter on a direct flight from Prestwick, Scotland, to Presque Isle, Me.

This record speaks for only one three-month period in one winter. Yet analysis of the reports yields very significant indications of North Atlantic weather in general. In most kinds of fronts, for example, it was found that there is an optimum flight level where there is a better than 50 per cent chance that no clouds will be found.

Icing was reported in various forms 112 times. But it proved less of a hardship to winter flying than might be supposed, simply because it was generally possible to fly at altitudes where icing was nonexistent or not dangerous, even though moderate to severe icing might exist at other levels on the same route. Terminal conditions and adverse winds were the most common causes of delays and rerouting, yet there were only 10 such cases out of the 69 flights flown during January and February.

It was also shown that storms could sometimes actually be used to advantage. Winds in the northern hemisphere blow counter-clockwise around the low pressure center associated with all severe storms. If such a storm lay directly on the projected flight course, it was sometimes found possible to fly a special course to the south, going east—or to the north, going west—detouring the storm center but taking advantage of its winds. Distance for an airplane is measured in hours of flying time, not in miles of ground distance. To fly a roundabout course with tailwinds often means shorter flight time than a direct course without tailwinds. Detouring a storm center also means less turbulence or bumpy flying, which causes fatigue to the crew and discomfort to the passengers. The weather officer's actual routine in the air is not simple. He must first of all keep a close watch on the amount, kind and height of clouds, and draw them accurately on his atmospheric cross-section. Not always easy in the daytime, it is a particularly difficult task at night. It is possible, however, even in the absence of the moon, to detect the presence of clouds below the plane and to judge their altitude if there are breaks so that the speed with which the dark spaces seem to move may be used as a gauge of height. Clouds above the plane are apparent from the disappearance of stars.

While he is not keeping watch on the clouds, precipitation and icing, the observer makes wet and dry bulb temperature measurements. He must also keep watch on the traces made by the aerograph pens, looking particularly for temperature changes marking fronts. At least every half hour he makes simultaneous readings of the pressure and radio altimeter. This is complicated by the tendency of the airplanes in flight to change altitude slightly but continually, so that both altimeters must be read at the same time, and by the fact that the radio altimeter, although a remarkably accurate instrument, is quite difficult to read exactly.

The observer must, once an hour, set down his observations in a number code for a radio message. This coded form in turn must be enciphered so that the enemy may not intercept and profit by it.

The ciphered messages are given to the plane's radio operator, who transmits them to one of the regular stations of the Army Airways Communications System. Taken at once to the weather office, the message is there deciphered. If it is of particular importance (as in locating a severe front), it is relayed by radio-teletype within an hour to all the important weather stations on the North Atlantic routes. At the end of the flight the observer gives all his messages to the weather station at his terminal of arrival, and a complete set is relayed by radio-teletype throughout the region. Forecasters all over the North Atlantic thus have available a complete line of reports from the point of departure to the terminal of arrival—a comprehensive record of winds, pressures, clouds and weather along the route. Combined with the daily flights of the 30th Weather Reconnaissance Service, these route reports give an unparalleled coverage of North Atlantic weather. END

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MARXMAN PIPES ease the tension... the strain of battle, the breakneck pace in the office and factory. Men of action everywhere depend on MARXMAN PIPES to relax... to lighten the load!
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AT FINE STORES—EVERYWHERE
»MARXMAN«
27 W. 24th Street, New York City

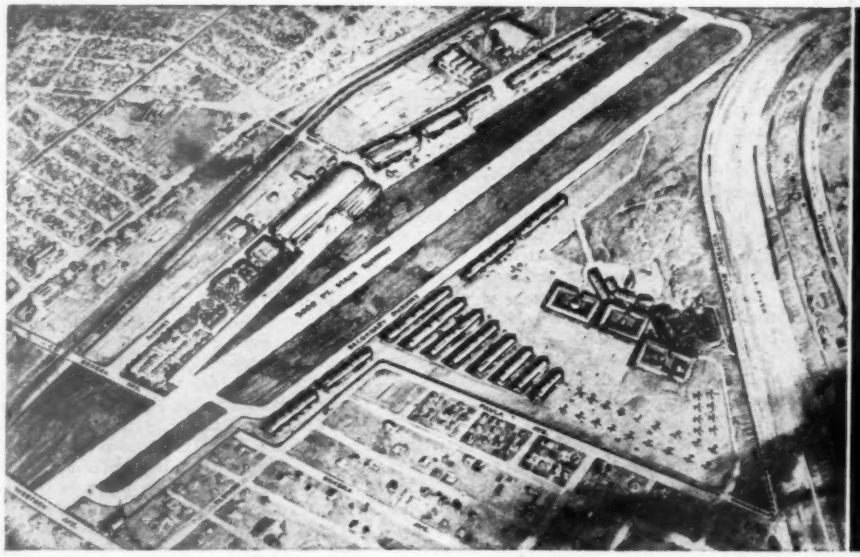
Marking Our Aerial Highways

(*Continued from page 29*)

has been proved to have greater visibility than any other color combination and is suitable for more different backgrounds of varying terrain. When terrain tends to obscure colors, whitepainted crushed stone or concrete markers are favored.

Chrome yellow on black was chosen following a series of tests and flight observations during which nearly all color combinations were checked in different areas of the country.

In planning a suitable distribution of air markers, the CAA divided the country into "grids," each 15 miles square, markers to be placed near the corner of each grid so that a flyer cannot be out of sight of a marker any considerable length of time. The original "grid" plan has been modified somewhat, as it became apparent that the most traveled routes require more markers and that very large cities should have as many as



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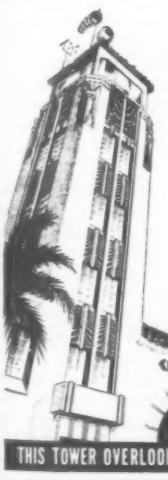

Established in 1929, Curtiss-Wright Technical Institute, now known as CAL-AERO TECHNICAL INSTITUTE, is one of the oldest, largest and most distinguished aviation schools in the nation, with a world-wide reputation. It has always enjoyed the greatest of popularity and recognition by the Aircraft Industry—a school at which to get the best to be had in the way of specialized training in AERONAUTICAL ENGINEERING AND MASTER AVIATION MECHANICS. This, together with the location in the heart of Southern California's giant aircraft industry, makes it the logical place to train for your aviation career.

With an unmatched and unparalleled record of safety and efficiency in training more than 20,000 pilots and 7,500 crew members—more than 1,200 having been decorated for valor—the training program under the personal direction of Major C. C. Moseley, President since 1929, has been continuous. At the same time and in addition to training this great number of army personnel, thousands of civilians were trained and graduated for the production front, in the Aircraft Industry.

Honored by citations for distinguished service by the Army Air Forces, together with its continuous service in training thousands of civilians since 1929, "Cal-Aero" has become synonymous with a new standard of accomplishment in Aviation Training. This is the direct result of SINCERITY OF PURPOSE achieved by MERIT ALONE, and implies two things:

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Second—Our own assured confidence in the future of Aviation.

Our first thought is borne out by the success of the great number of our graduates in all phases of Aviation Activity, in both military and civilian operations. What this school has done for these graduates it can do for you. In light of our assured confidence in the future of Aviation, "Cal-Aero" has purchased the famous Grand Central Air Terminal, Glendale, California, classified by C.A.A. as a Class IV Airport—"Suitable for the largest aircraft now in use or planned for the immediate future."

Thus Cal-Aero Technical Institute emerges from the war larger, stronger and finer than ever before, where civilian students from many states and foreign countries today, as in the past, continue to enroll despite the difficulties of war-time travel. Among these students are a large number of returned service men. Anxious to fit themselves for an outstanding place in the Golden Age of AVIATION which is certain to follow the war, they have enrolled upon discharge.

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a dozen. While Mrs. Noyes maintains that painted rooftop markers are "the best possible type" from a visibility standpoint, other types are more suitable for certain sections of the country.

The rooftop marker is best in mild climates where there is not much snow. In northern sections, where snows may last a long time, markers should be painted on the sides rather than the tops of buildings so that they are not obscured by snow. Markers in regions with heavy snowfall may also be painted on sides of silos, grain elevators, or water towers.

Letters and arrows formed of crushed rock and painted white are recommended for mountain sides. In desert areas, letters should be made of metal strips with enamel coating and mounted on posts a few feet above the ground so that sand drifts will not obscure them.

Air markers may also be placed on highways in areas where there is not too much snow, and a large number of these highway markers have already been installed. They are not considered as satisfactory as rooftop markers, however. Another variation of the air marker is formation of letters and symbols with small shrubs on lawns, road intersections and cloverleaf drives. In climates where shrubs lost their leaves in winter they should be evergreen.

In all cases, ground markers must have letters at least 20 feet in height, while 10 feet is the minimum for rooftop markers. Many markers erected before the war were too small. If the name of a town is long, it is better to abbreviate the name than to reduce the size of the letters. Width of the letters should be one-eighth of the height. Wider letters may blur, however.

In selecting a rooftop, the following factors should be considered: the roof should be in good condition; it should be a prominent roof near the center of the community or near a main highway or road; the view should not be obstructed by overhanging trees or tall adjacent buildings; it should be located where it will not be obstructed by smoke. These rules also apply to highway air markers. The CAA will advise as to a suitable location for markers, but no CAA approval of the site is necessary.

All air markers installed before the war now need repainting, and latitudes and longitudes should be added. The 2,500 markers which were blacked out need replacement and more than 70,000 new ones must be installed.

Maintenance of markers is not expected to be a serious problem. Rooftop markers need repainting about every three years, depending on weather conditions. Highway markers must be repainted whenever necessary, and CAA recommends that they be inspected at least twice a year for signs of wear. Ground markers of crushed stone bound together with cement require only an occasional repainting with a white cement and skimmed milk mixture. Other ground markers, constructed of loose aggregate, should be repainted at least once a year. Pruned shrub markers require constant care and upkeep.

CAA has made no recommendations as to how communities shall maintain their markers, but it is suggested that civic groups may volunteer for the job. CAA flight surveys to check condition of all markers may soon be authorized.

In many states, plans for extensive air marking systems are well advanced—work has already been started on some. The Army last fall removed its ban on markers on the east and gulf coasts and only the area 150 miles inland along the west coast is now subject to the restrictions. Although labor and equipment shortages are hindering installations elsewhere to some extent, there is much enthusiasm for the program.

State aeronautical commissions in Tennessee, Alabama, South Carolina, Minnesota, Nebraska, Illinois, West Virginia, and Connecticut have their programs ready and some work started. In Massachusetts, North Carolina and Missouri—states which have no aeronautical commissions—committees have planned statewide programs in which cities will participate by placing their own markers.

The Civil Air Patrol is backing the program in North Carolina, and the CAP in Texas has begun a project to mark 500 Texas towns.

Chambers of commerce in the state are also co-operating. Pennsylvania has a well-advanced program.

In many other states, legislation providing funds and working methods is under way.

Illuminated air markers are included in the post-war sky-sign program. These will be much more expensive to construct, maintain, and operate, but they will be the last word in aerial signposts.

Two general illumination systems are applicable: direct light, in which markers are outlined by exposed incandescent lamps or gaseous-discharge tubes, placed along the center line of letters and symbols; and reflected light, in which case either floodlight projectors with spread lenses or industrial reflectors are arranged to give a uniform distribution of light over the entire surface of the markers.

The direct light method is more effective than floodlighting because it gives greater brilliance. Either method may be used for roof markers, while reflected light is considered best for ground markers. Oil companies have installed a very few illuminated markers—a general installation program is not an immediate prospect.

Incidentally, while the exact origin of air markers is somewhat clouded, Mrs. Noyes believes the idea originated with large oil companies. Several years before the national air marker program was launched, several oil companies began to mark all the towns where they had gas stations. The Standard Oil Company of Ohio constructed many markers, while Standard Oil of California and the Richfield Oil Company had large pre-war air marking programs on the west coast—and did their own obliterating after the Army's ban was imposed.

To aid groups planning air marker installations, CAA has designed a set of three plywood templates with which unskilled laborers can lay out any letter of the alphabet or any figure from 10 to 20 feet in height. Templates are available

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to interested groups. The air marking bulletin tells how to use the templates, how to mix paint, how to select the site, and gives other pointers needed by groups embarking on air marking programs.

Air markers now offer the simplest, cheapest, and most effective guides for private flyers and it is anticipated that they will be needed for a number of years. Eventually, radio aids may be perfected for the private pilot so that the system of air markers will no longer be required—but that day, according to CAA, is a long way off.

How far the international marker program will be extended in the immediate future is a question that will have to go unanswered until a final agreement is approved by all nations concerned. This should be on the books by mid-1945. END

Is Battle-Bombing Doomed?

(*Continued from page 52*)

every heavy bomber formation that goes out to hit Germany in full daylight with an escort of fighters at least as numerous as itself.

Sometimes one and one-half fighters go out for every one heavy bomber. Only on the rarest occasions is there fewer than one fighter for every bomber. When they operate against battered Germany and the battered German air force the heavy bombers must have strong escorts if they are not using the cover of darkness or cloud.

Only in the Pacific is an exception to this rule to be found. There the *Superfortresses* are attacking Japan without fighter escort. But I believe that the reason for their success is technical rather than tactical.

We may say, therefore, that the courageous experiment with unescorted heavy bombers, made by the United States Army Air Forces and particularly by the Eighth, from England, has failed. We have returned to heavily escorted or under cover bombing.

In London the American experiment was watched with intense admiration and interest. If the *Fortresses* had proved that they could fight their way through to their objectives in full daylight without fighter escort they would have changed the fundamental pattern of air war.

In full daylight their bombing could be more accurate than the RAF night bombing, even when this was aided by the pyrotechnic markers laid by the Pathfinders. But the fighting was grim. At one time the massed .50-caliber guns looked as if they were going to beat the Mauser cannon of the Messerschmitt Me-109's but it turned out otherwise. The fighter escorts had to be brought in to hold off the enemy intercepters.

It must be remembered that the heavy bomber, going out in full daylight, even when it has a fighter escort, must devote a larger part of its useful load to guns and ammunition than the under cover bomber. That is one reason the RAF heavies carry bigger bomb loads than the comparable American heavies.

We may set out what has been learned about heavy bombing, and has been confirmed by the latest operations over Germany, as follows:

BIGGER BOMB LOAD: Under cover bomber [*Lancaster* and *Halifax*].

LOWER LOSS RATE: Under cover bomber [*Lancaster* and *Halifax*].

HIGHER ACCURACY: Battle bomber [*Fortress, Liberator* and *Superfortress*].

In manpower, fuel consumed, ammunition used and organizational demands the under cover bomber is superior against a well-equipped enemy to the full daylight fighting heavy bomber which I have called a "battle bomber."

The *Superfortress* is succeeding against Japan because it is technically ahead of Japanese equipment. When a new aircraft comes out it may for a time be able to break the "rules" of air war by virtue of its technical superiority.

As jet and rocket fighters come into service in greater numbers the heavy bombers will need cover or yet stronger escorts. It is time that those who plan technical development gave up the illusion of the self-defending heavy bomber. Self-defense is sometimes possible for a light bomber.

But even here escort is sometimes needed. When the force of *Mosquitos* under the late Group Capt. P. C. Pickard (of the film "Target for Tonight") made their jail-breaking attack at Amiens on the morning of February 18, 1944, to release 100 French patriots who had been condemned to death by the Germans, they had a fighter escort. [See FLYING, February, 1945.]

If these views are right, heavy bombing will tend increasingly to be done under cover of clouds and darkness. Full daylight bombing will become the responsibility of the light, high-performance bombers and fighter-bombers.

It follows that new instrument developments will exert a powerful influence upon the weight and effectiveness of the attack. Great progress has been made in instrumentation for heavy bombers both in the United States Army Air Forces and in the RAF.

It can be said, however, that we are near the time when an aircraft working entirely on instruments will be able to find a Japanese battleship in mid-Pacific, bomb it by instruments, and return without ever getting a direct visual sight on the target.

Generally speaking the finding of a target is still largely dependent upon that age-old device, the magnetic compass, and the only advance on this is the new American flux gate compass. This, although still fundamentally magnetic, does not use an ordinary magnetic element.

Most other developments depend upon associating a gyroscope with an ordinary magnetic element and this has been the line of progress of the Royal Air Force. The gyroscope has been experimented with by British workers since 1917 (at one of the Royal Flying Corps research stations) with the object of causing it to stabilize and to iron out the errors of the ordinary magnetic needle.

Once the turning and acceleration er-

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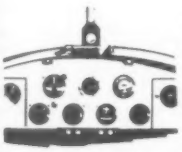
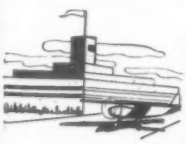


Maybe you'd rather get into a specialized field. In that case, think seriously about aircraft instruments. There will be MORE private and commercial planes flying, all using MORE instruments, including important developments made during the war. There will be a need for many MORE instrument technicians, and relatively few men who are trained for these positions.



Perhaps you want to be a business man in aviation. It's been officially estimated that there will be nine to fifteen thousand new airports—and these will be managed and operated by business men who know aviation and Airport Management. It's a field with an attractive combination of interests—another field for which Aero Tech offers specialized training.

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rors of the magnetic needle can be eliminated, it can be linked up with the automatic pilot, with bomb sights and with other equipment. It becomes useful in blind bombing or bombing in bad visibility.

When it is worked in with radar aids it can transform the whole picture of under cover bombing. In short, it would seem that the future of the heavy bomber lies largely with automatic and semi-automatic navigation and control.

Perhaps it was reasoning of this kind that led the enemy to devote so much effort to V-1 and V-2. But although his reasoning was right, his timing seems to have been wrong. He began to use his flying bomb before the heavy bomber, working in full daylight but with strong escort, had had its say.

Enjoying a marked production superiority over the enemy, the Allies have been right in paying so much attention to the heavy bomber. To them the heavy bomber has been of great service. It is only when one takes what it has done as a basis for trying to forecast future developments that one sees it is approaching the limits of its powers in some fields.

In the future it must work increasingly in clouds and darkness, while the daylight precision work must be transferred to ultra-high performance medium and light bombers. And even they may have to call on fighter escorts to penetrate screens of jet and rocket fighters. END

Return from Yawata

(*Continued from page 27*)

lodge it. The navigator hurried forward to help him. The engineer shook his head. He said: "That won't do any good. Power's shot. I don't think it will come down."

S/Sgt. Herman Sigrist, Zanesville, O., the right gunner, sat down in the door and rolled out head first. He also pulled twice before his parachute opened. As the white silk cloth blossomed out, Sigrist crashed into a tree. There followed a terrible moment of splintering, ripping and cracking, then Sigrist was swaying at the end of the shrouds, his feet just a yard from the ground. His first reaction was to reach for his canteen and take a long drink of water. He had landed in the only tree in the center of a Chinese courtyard. Soon he was surrounded by jabbering residents of the house who helped extricate him. They led him out of the courtyard, through the house and towards the landing field. He insisted they take some cigarets for their aid. At first they refused, then timidly accepted.

Lieutenant Teach took the controls as the pilot wrestled with the emergency landing gear release.

The engineer said: "No. 2 out."

The pilot grunted: "Okay."

The *Windy City* was running on one engine.

S/Sgt. Therman Hassinger, Reedsville, Pa., the tail gunner, sat down and rolled out forward. His parachute opened close to the ground. He started to call out, trying to locate the other jumpers. Just then he tumbled onto the thin tile roof of a Chinese dwelling. With a crash and a clatter he fell through and landed in bed with a Chinese and his wife. Tiles spilled all around them. A baby began to bawl. Hassinger reached for his flashlight. A squeal of fright greeted the bright beam. The woman, nude, reached for a dress and fled. Embarrassed and dazed, Hassinger started talking and making signs. The husband, recovering from the shock of the rude awakening, nodded, dressed, and led Hassinger to Chinese authorities.

Lieut. Arthur Garey, Los Angeles, the observer, was last to jump. He landed hard in a rice field but was uninjured. He began walking towards the airfield. Meanwhile, Sigrist, also en route to the base, heard Mertz calling for help. He found the injured gunner, made a mat of his parachute and urged him to lie down. Sigrist finally reached a tent at the end of the runway. A telephone call summoned an ambulance for Mertz.

Major Askounis stopped trying to release the nose wheel. It was too late to jump. They would have to ride the *Windy City* down. They were dropping nearly 500 feet a minute. He couldn't afford to "pour the coal" to No. 3 engine. What few drops of fuel were left had to be nursed carefully. The engine was running on about half power.

Realizing they were trapped, the men resigned themselves to a crash landing.

Glued to his seat, the radioman continued to signal the tower.

The bombardier stretched out on the cabin floor on his back and braced his feet on the bombsight stanchion.

The navigator placed a padded parachute seat on his desk and put his head down, cushioned in his folded arms for protection. He waited for the breaking glass, the fire.

The co-pilot began to intone the air speed as the plane dropped: "One eighty . . . one seventy . . . one sixty . . ."

The landing lights were lowered and working. In a flash, Major Askounis saw the operations building and the runway. He guessed at the location of the belly landing strip.

"One forty . . . one thirty . . . one twenty . . ."

Major Askounis wondered how they would land. Spin—end over end—what? There was no way of knowing. He strained at the controls to remain master of the heavy plane.

"One ten . . . one hundred . . ."

The *Windy City* skimmed over the sprawling E-building, then slid into the ground. The plane shuddered, groaned as its belly seemed to be ripping apart. Dirt and rocks spewed through the open nose well and showered the men inside. The twin nose wheels spun crazily. The propellers gouged the turf and bent under the strain. Suddenly the plane stopped skidding. Then all was still, save for the steady snarl of the "putt-putt" in the rear.

The six remaining crewmen, all unhurt, scrambled out of the plane, fearing fire. But there was no fire. No. 3 engine had run out of gas. The *Windy City* had greased in on a dead stick landing. END

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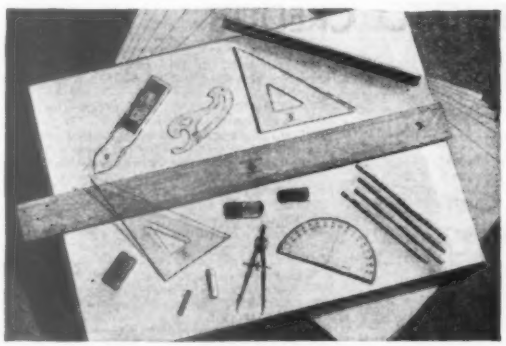

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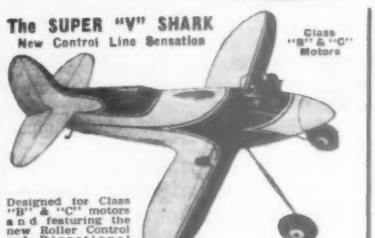

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Letters

(Continued from page 74)

in other states—for example, in Alabama—have obtained such permission. For your information, a little over a year ago two companies who proposed to operate intrastate airlines insisted that the Alabama Public Service Commission grant them a hearing. The Alabama Aviation Commission was also asked to sit in on the hearing. Since both commissions felt that they had no authority to issue certificates, they requested the attorney general of the state for a ruling. His ruling was that no state body had authority to issue airline certificates of convenience and necessity and the cases were dismissed.

The aviation commission has recently informed the governor of the state that we do not want any legislation which would give us the authority over intrastate airline operation. Our main objective is to promote and encourage the advancement of aviation in all forms. We have absolutely no desire to set up a little CAB for the regulation of intrastate aviation. The writer himself believes that in the future there will be no such thing as an intrastate airline.

HAYDEN BROOKS, Chairman
Alabama Aviation Commission
Birmingham, Ala.

Sirs:

The title to the lead article in your January issue might have been more fairly put if it had read "Must We Have 48 Air Dictators or Shall We Have One Czar of the Air?"

With forecasters estimating 300,000 aircraft by 1950 and authoritative indication that only about 3,000 of them will be used for domestic air transport, the question of controlling the 297,000 private planes is most pertinent. Buck Steers, director of aeronautics for Michigan, points out that CAA control of the situation within the states would require the equivalent of an army division. Obviously the problem involves co-operation in the enforcement of Federal regulations on the part of municipal and state law enforcement officers. The revised uniform code of the NASAO does much to eliminate the legal difficulty involved.

The states, particularly those where aviation activities required that action be taken, were really the first agencies to act in the matter of air traffic regulation. The Federal Government is the "Johnny-come-lately." And no less a spokesman than Oswald Ryan of the Civil Aeronautics Board points out that there is a gap in civil regulation and control which can only be filled by the action of the states.

L. L. SCHROEDER, Commissioner
Minnesota Department of Aeronautics
St. Paul, Minn.

● The revised NASAO code was endorsed after the article in question was in print. It was presented in the February issue of FLYING as a footnote to an article dealing with the legal aspect of state-Federal aviation relations. It is open to question, however, whether the states will follow this moderate program simply because it is endorsed by the NASAO. Counter acts have already been proposed, notably by the National Association of Railroad and Utility Commissions. The American Bar Association believes that uniform regulation can be accomplished only through Federal legislation.—ED.

Sirs:

I am from Minnesota and I fly—that makes me familiar with the problem of state control in aviation which you presented in the article "Must We Have 48 Air Dictators?"

Taxes have been imposed on airplanes and pilots, yet there has been no visible returns to benefit aviation. And there are many other interferences.

DONALD T. SWANSON
Port Heuneme, Calif.

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Aviation's Mike-Talk

(*Continued from page 64*)

nautical services "*Pan*" always means that the plane transmitting it has been forced down, but the need for assistance is not so pressing as to justify the use of the distress signal "*Mayday*."

With reference to the use of "*Pan*," all flying personnel in this country should know that in the Army Air Forces it is sometimes used as a distress signal. An AAF regulation specifies that if because of violent maneuvers the pilot of a plane in distress is unable to signal "*Mayday*" followed by a distress message, the use of "*Pan*" not followed by any message will convey the same meaning.

Adoption of joint British-American procedure has not changed any of the other emergency signals. "*Mayday*" is still the International radiotelephone distress signal, and "*Security*" is still used by ground radio stations to prefix the transmission of messages concerning the safety of navigation. Stations equipped with automatic alarm devices, however, no longer use the safety signal.

For the exacting radiotelephone operator, it might be well to mention that the pronunciation of the figure "9" has been changed in joint procedures. We've been saying "ni-yen" in imitation of our telephone operators; now the word is "niner."

Another proword that has crept into use since the adoption of the joint system is "*Break*." The word is used to indicate separation of the text of a radiophone message from the heading, and again from the signature or suffix.

Joint radiotelegraph procedure is not in use yet, but it will be shortly. There will be very few changes from that now employed in this country. One alteration is worthy of note; that is, the meaning of the prosign AR. Radio operators in American planes have been taught that AR means "end of message, answer." As British-American radiotelegraph procedure has it, *AR* means "end of message; no answer expected." In other words, *AR* is the prosign equivalent to the proword "Out." The prosign *K* will be used to mean "end of message, answer," as well as the invitation to transmit following a radiotelegraph call-up. It is doubtful whether that change will effect commercial circuits. Nevertheless, all concerned should note the change, in view of the large number of contacts between Army planes and civil stations.

In summary, the example of Army plane 18190 establishing contact with the CAA radio station at Chicago, and the subsequent communication is given below, using joint British-American radiotelephone procedure:

"Chicago Radio *this is* Army one eight one nine zero; *over*."

"Army one eight one nine zero *this is* Chicago Radio; *over*."

"Chicago Radio *this is* Army one eight one nine zero; Pilot Jones; five miles south Chicago, one six three zero; five thousand feet, on instruments; *over*."

"Army one eight one nine zero *this is* Chicago Radio; *say again* all between 'five miles' and 'Chicago;' *over*."

"Chicago Radio *this is* Army one eight one nine zero; *I say again:* five miles south Chicago; *over*."

"'Army one eight one nine zero, Pilot Jones; five miles south Chicago, one six three zero; five thousand feet, on instruments;' *over*."

"Chicago Radio *this is* Army one eight one nine zero; that is *roger; over*."

"Army one eight one nine zero *this is* Chicago radio; *roger; out*." END

Intended Meaning	Joint Prowords
From; calling	*This is*
Go ahead; answer	*Over*
End of contact; that is all	*Out*
Repeat	*Say again*
I repeat	*I say again*
Wait	*Wait* or *standby*
Mistake	*Correction*
Received	*Roger*
Received and will comply	*Wilco*
Urgent message	*Emergency*
Operational priority message	*Immediate*
Priority message	*Important*

I Learned About . . .

(*Continued from page 72*)

tination when I asked him how much time he had to run on his ETA—he "thought" he had 10 more minutes. The upshot of it was that we flew past our destination, past the Ohio River, and that finally I had to take over and land at Warsaw, Ky., for more fuel. When I refused to endorse his student certificate for solo navigation he became indignant. Another instructor endorsed his certificate eventually. But it wasn't long after that that this student washed out his airplane on a solo navigation flight. His accident was caused in a forced landing after he became lost.

On another occasion, I briefed a student on the weather situation for a local training flight. The winds aloft were about 30 m.p.h. from the north. The visibility was four or five miles. I cautioned him to keep the airfield within sight at all times, and to check the position of the field after every maneuver. He took off for a solo acrobatic flight at 8 a.m. and he was due to land an hour later. The next time I heard from this student he was at another airport (50 miles west) and it was 11:40 a.m. He had disregarded my advice to keep the airfield in sight and become hopelessly lost. This student, like countless others, had been properly instructed but simply lacked flying judgment.

Another example concerns instrument flying and a little pride. About two years ago I was flying on instruments in stratus clouds, cross-country. My passenger, a private pilot, had about 160 hours of flying time. Ceilings along the route were down to 700 feet and the temperature on the ground was about 78°. The trip was uneventful. About six months later, I flew over this same route with the same passenger. In the meantime, he had acquired a commercial certificate with instrument and flight instructor ratings. I was flying the same equipment, and I had taken an IFR clearance due to low visibility, although the ceilings along our route were reported at 2,300 feet. The ground temperature was about 37°. About 15 minutes from our starting point the ceiling socked right down to the ground. I executed a 180°—turn and headed back for the starting point and landed. I had an instrument rating which claims that I can fly instruments. I had an airplane equipped for instrument flying. I had complied with all CAA regulations. Why did I turn back? I did not have any deicing equipment installed on the aircraft and I thought there was a fair possibility of picking up ice. My passenger berated me for turning back—he claimed he could have gone through. I'll never know because I didn't give him the chance. I've learned plenty about flying from such experiences.

Needless accidents are the underlying cause for most of the stringent CAA regulations. A pilot is granted a certificate (after successfully completing his examinations) and he is expected to exercise sound air judgment when using that certificate. The CAA cannot regulate a man into exercising such judgment but some of the regulations are designed so that a pilot is unable to exercise bad air judgment with resulting loss of valuable equipment and sometimes loss of life. END

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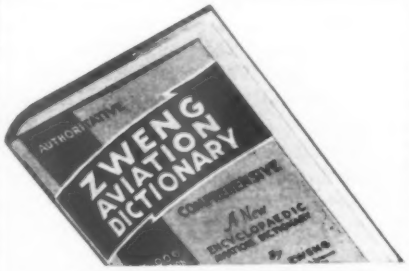

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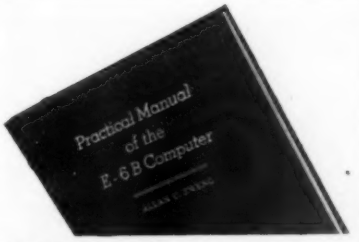

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No. 2 - WOOD

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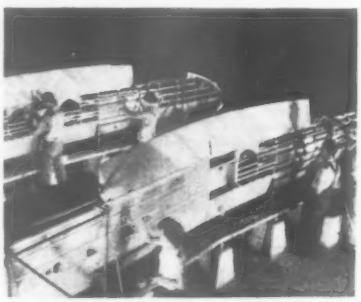

Here is shown the externally stressed skin wing in different stages of completion. Gas tanks are visible within the framework of the structure. At the left of the wing in the foreground the skin has been applied which is plywood bonded together with plastic resins which form a stressed skin shell providing maximum strength

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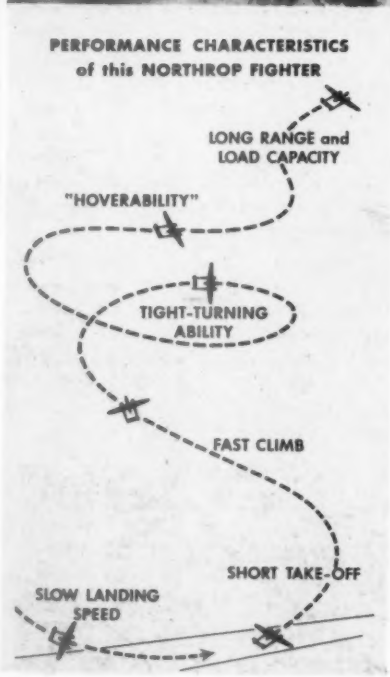

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More, it lands slowly, takes off quickly — reducing the hazards of small, blacked-out airstrips.

Much of this handling ability is due to Northrop-developed "retractable ailerons" designed into the wings, the first on any plane.

Even in a small fighter such performance would be an achievement in design. *The Black Widow however, is big as a medium bomber — with great range and load capacity.* It carries a 2 or 3 man crew protected by armor plate . . . plus night-fighting equipment . . . large fuel tanks . . . 20 millimeter cannons, .50 caliber guns and ammunition!

The Northrop group, with a long record of achievement in aerodynamic development and production, regards the Black Widow P-61 night fighter as its outstanding contribution to the war effort. And it believes that many Black Widow design features will prove valuable in peacetime aircraft to come.

NORTHROP *Creators of the* ***Flying Wing*** *and the* ***Black Widow*** *P-61 Night Fighter*

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